NORTHUMBERLAND SEA FISHERIES COMMITTEE.

REPORT on the Scientific Investigations

For the Year 1903.

EDITED BY ALEXANDER MEEK, M.Sc., F.Z.S.,

THE MARINE LABORATORY, CULLERCOATS, AND THE DURHAM COLLEGE OF SCIENCE, NEWCASTLE-UPON-TYNE.

Printed by order of the Committee, 15th October, 1903.

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SUMMARY AND GENERAL REPORT.

I beg to submit the following Report on the scientific investigations for the year 1903.

Last year I had to record an extraordinary increase in the numbers of the fishes of the inshore waters, from the results of our trawling experiments, and it will be remembered that our experiences were completely in accordance with those of the fishermen, for the season was much above the average in all branches of the industry, and in some it formed a record. It was therefore with the greatest interest that we approached the trawling experiments this year, if only to see if the improvement would be maintained. The results for the important flat fishes for the two years are:—

	Turbot.	Sole.	Plaice.	Dab.	Flat Fishes.
1902	4	21	165	121	317
1903	13	53·7	180·6	115·5	321

It will thus be seen that, broadly speaking, the figures are rather better this year. The most interesting increase is that recorded for soles. Most of the stations participated in the increase, but Cambois Bay in July yielded more soles than any other species, and six weeks later the number of soles was almost the same as that for plaice and for dabs.

An analysis of the returns shows, however, that the above results are due to the large catch made this season at Skate Roads, and that the other bays have suffered a slight regression as compared with last year. This will be apparent from a consideration of the following summary of the results for the two years:—

BLYTH BAY.

	Turbot.	Sole.	Plaice.	Dab.	Flat Fishes.
1902	—	23	290	89	404
1903	3	20	207	122	362

CAMBOIS BAY.

1902	0·7	18	114·3	115·7	255·0
1903	6	126	100·5	88·5	321·5

DRURIDGE BAY.

	Turbot.	Sole.	Plaice.	Dab.	Flat Fishes.
1902	... 8·5	... 21·5	... 260	... 164·5	... 459
1903	... 15·7	... 51	... 171·3	... 150	... 392·3

ALNMOUTH BAY.

1902	... 6	... 23	... 111·3	... 108	... 255·3
1903	... 17·5	... 41	... 82·5	... 94	... 242·5

SKATE ROADS.

1901	... 19·5	... —	... 113·5	... 10·5	... 147·5
1903	... 20	... 5	... 455	... 68	... 580

Skate Roads had on this occasion gained conspicuously in all forms, but more especially in dabs and plaice.

Alnmouth Bay shows only an increase in prime fishes, especially soles, but in plaice it is worse than the average of all the previous experiments, and dabs are just about up to the average.

Druridge Bay is still above the average for all forms, but shows a large decrease compared with last year as regards plaice and a slight decrease in dabs.

Cambois Bay is also much above the average for all classes of flat fishes, but the increase in soles is a remarkable feature of this season.

Blyth Bay is almost identical with last year, and is on this account in a very much improved condition compared with the average since the experiments were commenced.

If our experiments thus indicate that the inshore waters are slightly worse this year, it is also quite clear that the improvement to which I have before drawn attention is maintained, when we consider the results over the whole period. The Committee has thus reason to be satisfied with the results of the trawling experiments, for they have demonstrated (1) that a large if variable number of flat fishes in the small and immature condition find food and shelter in the in-shore waters of Northumberland, and (2) that the flat fishes appear to be gradually increasing in numbers.

The statistics for the year show that while the season has not been so good for the herring and for the salmon fishing, the white fishing has been even better than that of the previous year.

Charts are given in the Report to indicate in a graphic manner the results of the experiments for each station considered separately.

Details are also furnished with relation to the food, maturity, etc., the plankton and the bottom life.

The opportunity was taken at the trawling excursions to mark with numbered labels certain of the fishes captured, and more especially plaice. Altogether 483 fishes were measured—the majority weighed—labelled, and returned to the sea. A few have been re-captured near to the places where they were liberated, but one of the plaice had migrated from Goswick Bay to St. Andrew's Bay.

The measurements and weights have been utilised for making a chart to indicate the relation of size to weight in the case of the plaice.

Another experiment as to the migration of crabs will be found interesting, for it goes to show that the migration of this form is not so simple as has hitherto been supposed. One of the labelled crabs migrated from Beadnell to the north of Holy Island, and another so far north as Portlethen on the Kincardineshire coast of Scotland.

Mr. Douglas, to whom we owe our thanks for this experiment, and Mr. Fawcus, have again given us complete records of their crab and lobster fishing for the year.

The Report contains a further paper by Mr. E. P. Witten, B.Sc., on the structural changes accompanying the ecdysis of the crab, in which he shows that growth by hyperplasia takes place after ecdysis, and ceases with the hardening of the new cuticle, and also that the internal pressure necessary for the ecdysis and the subsequent growth is furnished by the ingestion of a large quantity of sea water. An account of our local Marine Algæ, which are so important as being the ultimate source of the food supply of the fish, is given by Mr. W. H. Young, F.Z.S. A note on a few additions to our list of the Marine Mollusca is contributed by Miss M. V. Lebour. I have described the egg of a species of Goby, and the results of my enquiries as to the presence of *Gammarus duebeni* in the Mill Pit at Blyth. I also give notes on new and rare fishes, and on the Beluga captured at South Shields.

Mr. F. J. Cole, of the Liverpool University, sends me the following with reference to his work here in August :—

"During last August I spent some time at Cullercoats with the object of collecting material of *Myxine*. In this I was entirely successful, and as every other source of supply had failed, I have much cause to be gratified for the existence of a marine laboratory at Cullercoats. I obtained a considerable quantity of small and adult *Myxine*, the study of which has since yielded many valuable

results. It seems to me quite possible that if a steamer were available, it would be possible to obtain the eggs and embryos of this animal—a scientific achievement greatly to be desired.

"It is a pleasant duty to acknowledge the active and perennial interest which Mr. Meek took in the work, and both to him and to the Fishery Officer, Mr. H. Taylor, I am indebted for the ready co-operation which ensured success."

The Laboratory has been greatly enriched by the valuable Leitz microscope bequeathed by the late Mr. G. P. Bulman. By his untimely death, I have lost a most valued friend. His interest in the Marine Laboratory and its work was never failing, and as will be seen in our reports, he contributed our earlier lists of Mollusca. He took a prominent part in the formation of the Northumberland Coast Club, and held the Honorary Treasurership from its commencement. He found time, moreover, to devote himself to the elucidation of some of the more philosophical zoological problems, and published several papers on his results.

Alexander Meek.

THE TRAWLING EXCURSIONS.

GENERAL RESULTS.

We are once more in the position to place before the members of the Northumberland Sea Fisheries Committee the results of a series of trawling experiments. These have been made as before with the co-operation of Ald. Dent, to whom we desire to offer our thanks for again so kindly placing the "Stanley" at our service along with the necessary fishing gear. It is only right to state moreover that the extra work entailed this season in carefully weighing, measuring, marking, and returning to the water nearly 500 of the fishes captured during the season was shared in by all who took part in the excursions, and for help in this and in the work generally we have especially to thank Mr. Saunders, of Blyth. The results of this part of the season's work done on the "Stanley" will be referred to in another section of this report, and in the meantime the trawling experiments which have been made precisely as they have been since they were started by Mr. Dent in 1892 will be briefly described.

The different experimental stations, of which particulars were furnished in last year's report, were this year visited as follows:—

Skate Roads, June 25th.—One haul was made from 3·20 to 4·20 p.m. in thundery weather, and was measured (Table III). There was a good deal of weed in the bay.

Skate Roads, June 26th.—An incomplete haul was made at 4·30 a.m., from the fact that the net became entangled with a piece of wreckage, and when brought aboard was found to be "split." The net, moreover, as on the previous day, contained a lot of weed.

Goswick Bay, June 26th.—We started here at 6·25 a.m., and misfortune still following us, we had not proceeded far when we found we were fast to a piece of wreckage once more. But on this occasion the result was much more serious, seeing that we lost the net. Another net was "bent," however, and we were thus able to get a haul, which was measured, and the results given in Table I. We left Goswick Bay at 11·30.

Skate Roads, June 26th—Returning to Skate Roads we trawled from 12·20 to 1·30, and thus obtained a haul which could be measured. The mid-day temperature was—air 62°, water 52° F.

In both Goswick Bay and Skate Roads fishing was difficult and afforded poor results owing to the great quantity of drifted weed. Anglers were captured with the other forms at Goswick Bay but not at Skate Roads.

Alnmouth Bay, July 1st.—Beginning at 11 a.m. we obtained a first haul of one hour's duration, and continued the trawling so as to complete a whole day's experiment as in previous years. There was a strong west wind but the sea was smooth. The mid-day temperatures were—air 66°, water 54° F.

Cambois Bay, July 9th.—The remarkable results, especially with reference to the capture of soles, were obtained on this day in good weather, the wind westerly, light, and the sea smooth. The mid-day temperatures were—air 66°, water 54° F. A very little weed was picked up by the trawl. The beam was unfortunately broken at this experiment.

Druridge Bay, July 15th.—Beginning at 10·10 a.m. and finishing at 7·20 p.m., a complete experiment was made. The weather was sultry, and rain fell all day. The sea was slightly rough, the wind S.E. The mid-day temperatures were—air 59°, water 55° F. A great deal of time was taken up clearing the net from the large quantities of weed. The trawl captured also *Cyprina islandica* and *Portunus holsatus*, the latter including many berried females and also "casters."

Blyth Bay, July 23rd.—Beginning at 9·25 a.m. an experiment of seven and a half hours was made. The forms obtained besides those recorded included anglers, *Portunus holsatus*, and a shore crab measuring $1\frac{7}{8}$".

Skate Roads, August 4th.—By far the most successful day's fishing we have yet obtained at Skate Roads was experienced this day. The sea was smooth but was gradually becoming rough, for there was half a gale blowing from W.N.W. The mid-day temperatures were—air 66°, water 56° F. *Portunus holsatus* was common as usual, and in addition there were many *Eupagurus bernhardus*, and one or two *Cyprina islandica*.

Druridge Bay, August 12th.—The net was put overboard at 10·10 a.m. and we trawled until 7·10 p.m. The wind was calm and the sea smooth. The mid-day temperatures were—air 64°, water 57° F. It has to be mentioned also that as in previous years a

number of very large plaice measuring over 20″ were captured, especially at the last haul. There was a great deal of weed, swarming as usual with the commoner amphipods. *Portunus holsatus* was obtained as before, and also the spawn of Natica.

Aln̄mouth Bay, August 19th.—We started here at 11·15 a.m. and finished at 6·45 p.m., losing however about three-quarters of an hour. The sea was smooth, the wind S.W. The mid-day temperatures were—air 61°, water 57° F. There was nothing noteworthy in the trawl other than the fishes recorded.

Cambois Bay, August 26th.—Starting at 9·33 a.m. we gave about ten hours to this bay. The weather was dull, with rain, the wind S.W., the sea smooth. The mid-day temperatures were—air 60°, water 57° F. The trawl captured, in addition to the fishes recorded, *Lutraria elliptica*, *Corystes cassivelaunus*, *Hyas araneus*, and *Portunus holsatus*, many of the latter in the process of casting.

Blyth Bay, September 2nd.—Beginning at 9·30 a.m. we trawled until 5·15 p.m., losing one hour however by returning to the harbour at 10·10. The day was dull and rainy, the sea was slightly rough, the wind E.N.E. The mid-day temperatures were—air 57°, water 55° F. A Sapphirine Gurnard, measuring 10½ inches was caught. Those obtained last year measured about 7¼ inches.

Druridge Bay, September 9th.—We began at 10·20 a.m. and gave eight and a half hours to the experiment. The sea was moderate, the wind N.W., strong. The mid-day temperatures were—air 60°, water 55° F. *Portunus holsatus* was common as usual. Two old female edible crabs were also picked up in the trawl. One had lost both the large claws and one of the legs, the other was similarly injured in the case of one of the legs. The wounds left were black and old looking, and there appeared to be no trace of regeneration. It is easy to see in such a case that casting or the ability to cast would be a blessing and old age a curse. It would appear that the power of regeneration, and that of ecdysis are correlated. A large piece of limestone was also brought up by the trawl.

THE MARKETABLE FISHES CAPTURED.

Last year we had to report a conspicuous increase in the numbers of the fishes of the in-shore waters, and we pointed out that our trawling experiments were completely in accordance with the experience of the fishermen, and also with the published statistics. It was scarcely to be expected that the exceptionally

TABLE I.

PLACE.	DATE.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Lemon Dab.	Whiting.	Codling.	Gurnard.	Skate	TOTAL.	Mid-day Temperature.	SEA.	WIND.
	1903.															
Goswick Bay, $3\frac{3}{4}$ hours ...	June 26th...	3	4	4	22	8	9	...	...	...	2	4	56	52 °F.	Smooth	Southerly
Alnmouth Bay, $7\frac{1}{2}$ hours...	July 3rd ...	20	...	52	97	102	5	...	...	...	14	...	290	54	Do.	W., strong
Cambois Bay, 10 hours ...	,, 9th ...	1	...	152	81	76	...	4	2	1 Lythe	4	3	324	54	Do.	W., light
Druridge Bay, 9 hours ...	,, 15th ...	7	1	74	101	107	9	...	...	2	48*x*	...	349	55	Slight	S.E.
Blyth Bay, $7\frac{1}{2}$ hours ...	,, 23rd ...	16	1	25	264	150	15	...	...	...	41	...	512	55	Smooth	S.E.
Skate Roads, 9 hours ...	Aug. 4th ...	20	7	5	455	68	25	...	...	...	75*x*	2	657	56	Slight	W.N.W., half a gale
Druridge Bay, 9 hours ...	,, 12th ...	19	...	44	212	210	2	...	...	1	168*x*	...	656	57	Smooth	Calm
Alnmouth Bay, $6\frac{3}{4}$ hours...	,, 19th ...	15	1	30	68	86	9	...	...	...	23	...	232	57	Do.	N.E. to S.W.
Cambois Bay, $9\frac{1}{2}$ hours ...	,, 26th ...	11	...	100	120	101	1	...	1	1 Lythe	81	3	419	57	Do.	S.W.
Blyth Bay, $6\frac{3}{4}$ hours ...	Sept. 2nd ...	3	...	20	207	122	10	...	...	2	84 *xx*	...	448	55	Rough	N.E.
Druridge Bay, $8\frac{1}{2}$ hours ...	,, 9th ...	21	...	35	201	133	1	...	...	...	63	1	455	55	Moderate	N.W.

x. Many caught by line. *xx*. Including one Sapphirine Gurnard.

high figures of the previous season would be maintained, but as a matter of fact the average results for the whole district are slightly greater than those of last year :—

	Turbot.	Sole.	Plaice.	Dab.	Flat Fishes.
1902—	4 ...	21 ...	165 ...	121 ...	317
1903—	13·3 ...	53·7 ...	180·6 ...	115·5 ...	321

It is only when we come to analyse the catches in detail that we find this high average to be due to the large increase which has this year characterised Skate Roads. The other bays have suffered a regression in the numbers of the commoner flat fishes, and this is accompanied by a remarkable increase in the numbers of prime fishes. The decrease, however, it ought be observed, is only as compared with last year, and the figures even for the plaice and dabs are still on the whole in advance of the averages for previous seasons.

The gradual improvement which our experiments have shown during all these years is therefore continued. Last year it was natural to associate the large catches made in the commercial way, as also the abnormally high figures we got in the course of our experiments, with the bad weather which characterised that year. In our own case this season we have a return to the more normal rate of advance, and as regards the experiences of our fishermen it may be said that while ground fishes appeared to be more numerous, mid-water fishes were less plentiful. The weather, however, has been worse if anything, although it must be said that the water was not so cold during the summer as it was in 1902. It has not been possible for us to enquire more deeply into the relationship between the external conditions and the fish life of these areas, and our work would have to be conducted on a very much larger scale if we were seriously to make the attempt.

That there is an increase in our average catches this year is due, as has been pointed out, to the extraordinarily large catch made at Skate Roads. At the latter station the average for plaice for the period 1894-1901 was 139·4. This year on the occasion of our August visit we obtained 455 plaice. Compared with last season the other stations all show a decrease with regard to plaice and dabs. Blyth Bay, however, is exceptional, in that there is this year a marked increase of dabs. Blyth Bay :—

	Turbot.	Sole.	Plaice.	Dab.	Flat Fishes.
1902—	0 ...	23 ...	290 ...	89 ...	404
1903—	3 ...	20 ...	207 ...	122 ...	362

As the various stations differ in regard to the proportion of the fishes and also in the variations they present year after year we have decided to bring the average results together for each, and also to depict the records in the form of a chart for each station.

TABLE II.—The average catch of marketable fishes each year at each station.

CAMBOIS BAY.

YEAR.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Flat Fishes.
1892	1·7	...	5	93·7	57	...	157·3
1893	3	...	9·5	55	31·5	...	99
1894	1	...	39·5	24	14·5	2	81
1895	3	...	4	54	23	...	84
1896	8	...	24	76	81	...	189
1897	2·5	...	23·5	83	93	...	202
1898	2	...	7	56	82	1	148
1899	7	1	19	125	112	...	265
1901	2	...	2	126	77	6	212
1902	0·7	0·3	18	114·3	115·7	6	255
1903	6	...	126	100·5	88·5	0·5	321·5

DRURIDGE BAY.

1892	...	...	13	140	70	...	223
1893	8	...	26	80	53	...	167
1894	17	...	20·5	98	47	2·5	185
1895	4	...	9·7	122·7	48·3	0·7	185
1896	10	...	23	140·3	86·3	0·7	260
1897	20·5	0·5	26	115·5	69	3	234·5
1898	8·7	1	4	86	104·3	2	206
1899	4·3	0·7	8	100·3	94	1·3	208·6
1900	8·5	1	11·5	110·5	83	0·5	215
1901	2·7	0·3	15	136·7	119·6	0·7	275
1902	8·5	0·5	21·5	260	164·5	4	459
1903	15·7	0·3	51	171·3	150	4	392·3

ALNMOUTH BAY.

1893	6	...	9·5	95·5	74·5	...	185·5
1894	13	...	10·3	85·3	49·7	8·3	166·6
1895	5	...	5·5	109·5	64	...	184
1896	11	0·5	19·5	178	80·5	3	292·5
1897	7	...	6	155·5	52·5	3	224
1898	10	1	1·5	156	86	11·5	266
1899	3·5	0·5	4·5	158·5	107·5	10·5	285
1900	2·3	0·3	16	118	130·7	14·4	281·7
1901	1	...	7·5	209·5	118·5	3	339·5
1902	6	0·3	23	111·3	108	6·7	255·3
1903	17·5	0·5	41	82·5	94	7	242·5

SKATE ROADS.

1894	23	...	1	230·5	26	14	294·5
1895	2·5	...	1·5	07·5	27·5	...	129
1896	27	0·5	2	149	9·5	33	221
1897	38·5	4·5	5.5	124·5	25	15·5	213·5
1898	15	3	1·5	124·5	27·5	6·5	178
1899	9·5	...	...	136·5	22	12	180
1901	19·5	1	...	113·5	10·5	3	147·5
1903	20	7	5	455	68	25	580

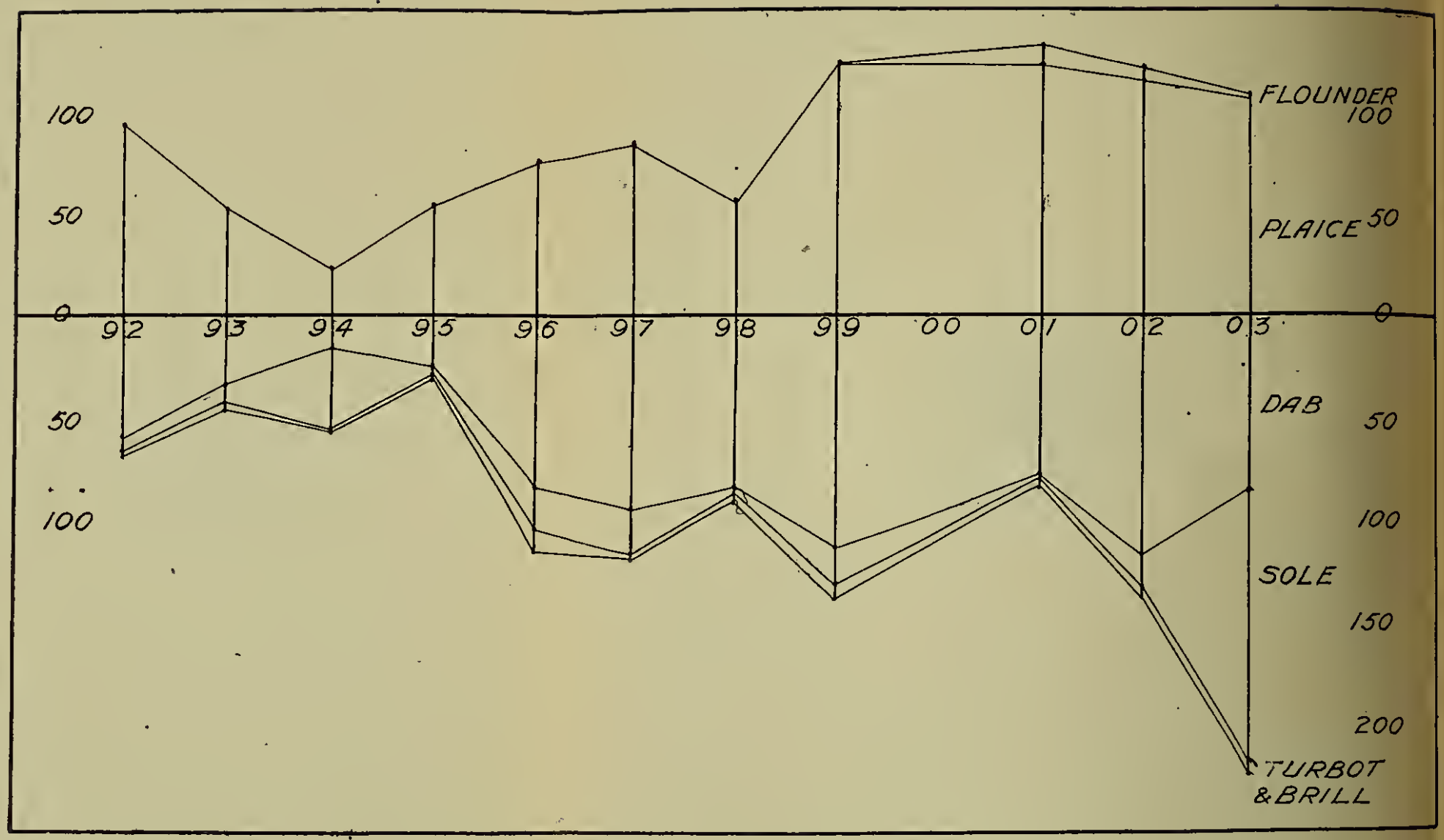


CHART I.

Cambois Bay.—The average catch of marketable fishes for each year from 1892 to 1903 (except 1900, when no experiment was made).

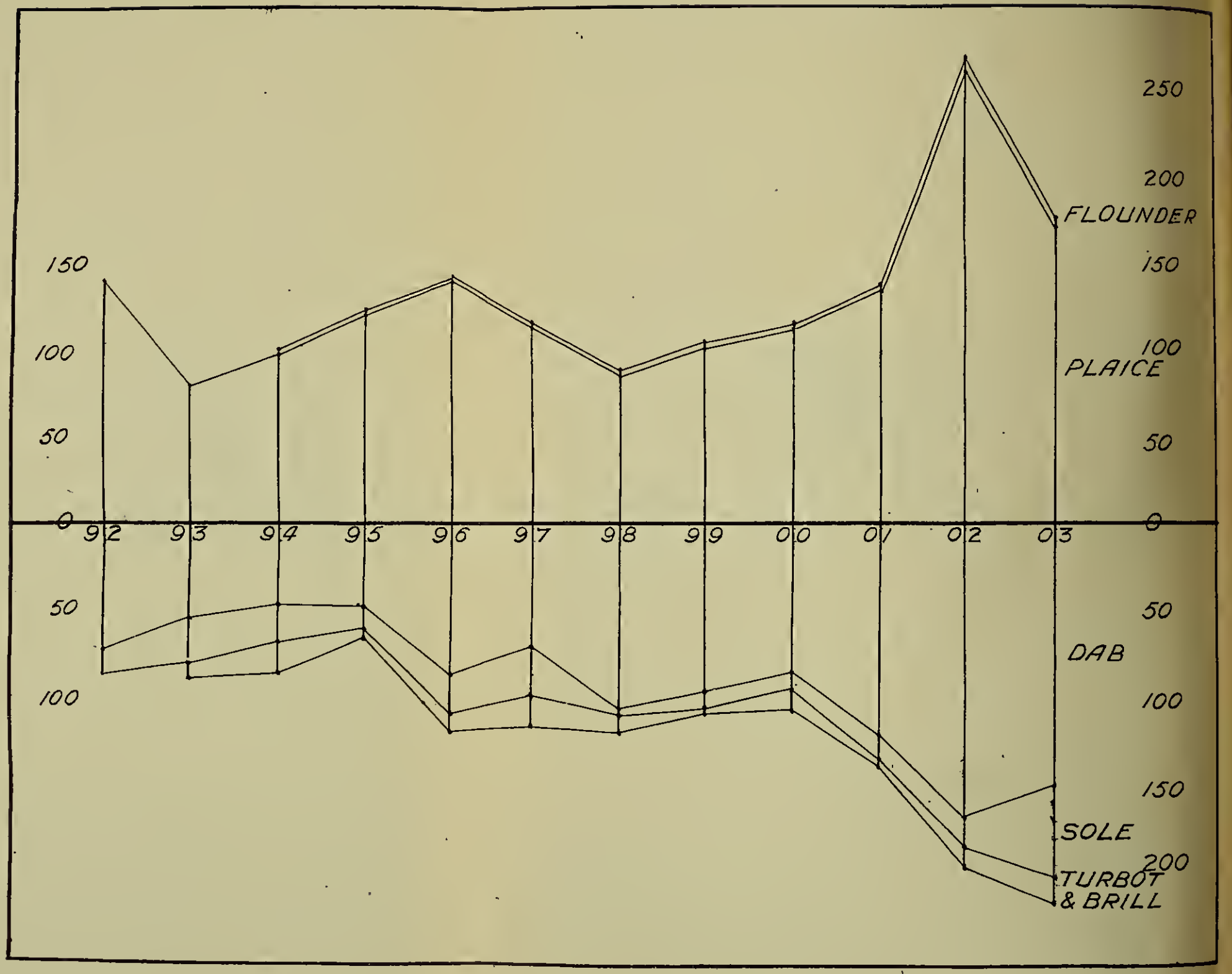


CHART II.

Druridge Bay.—The average catch of marketable fishes for each year from 1892 to 1903.

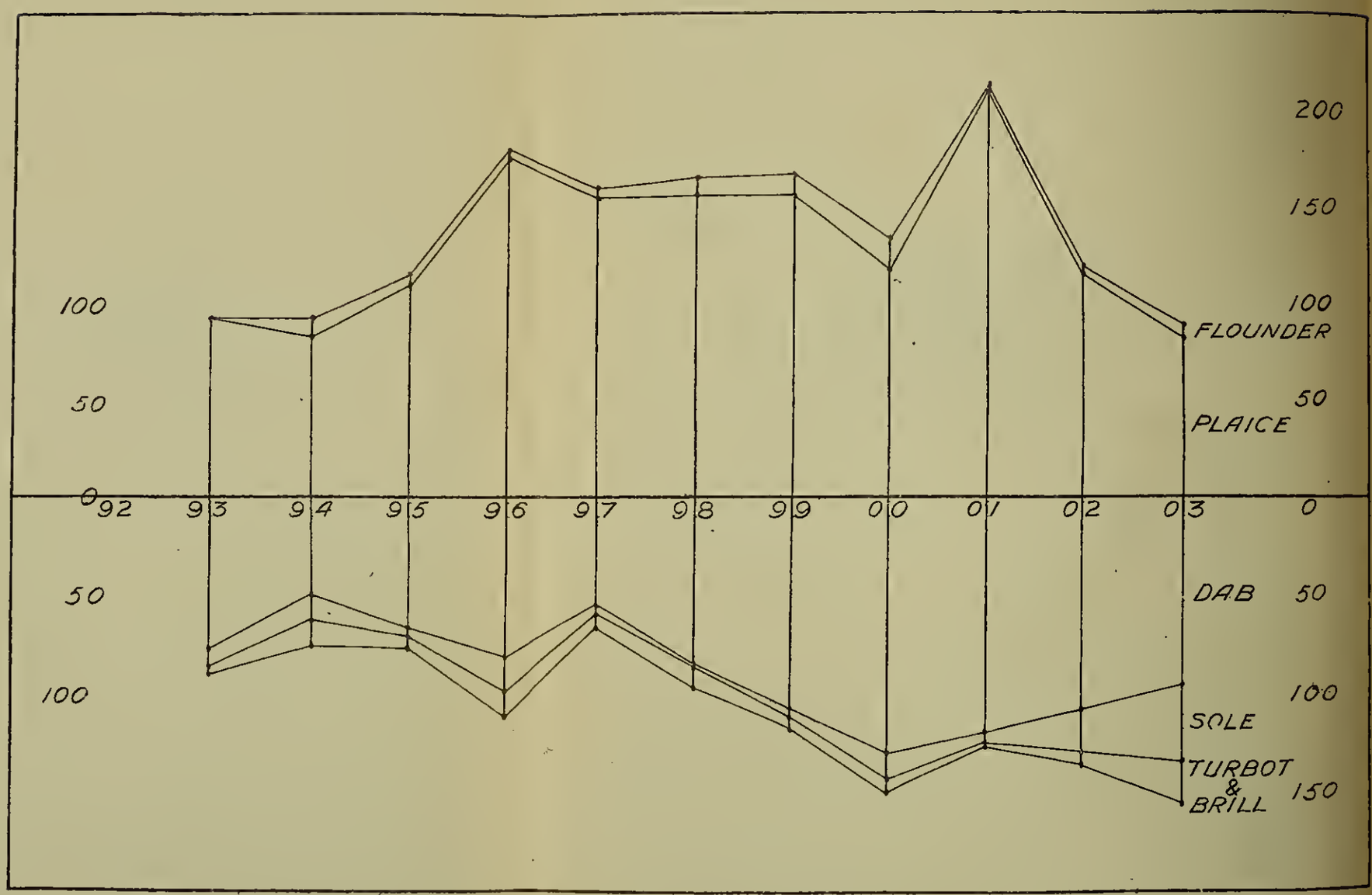


CHART III.

Alnmouth Bay.—The average catch of marketable fishes for each year from 1893 to 1903.

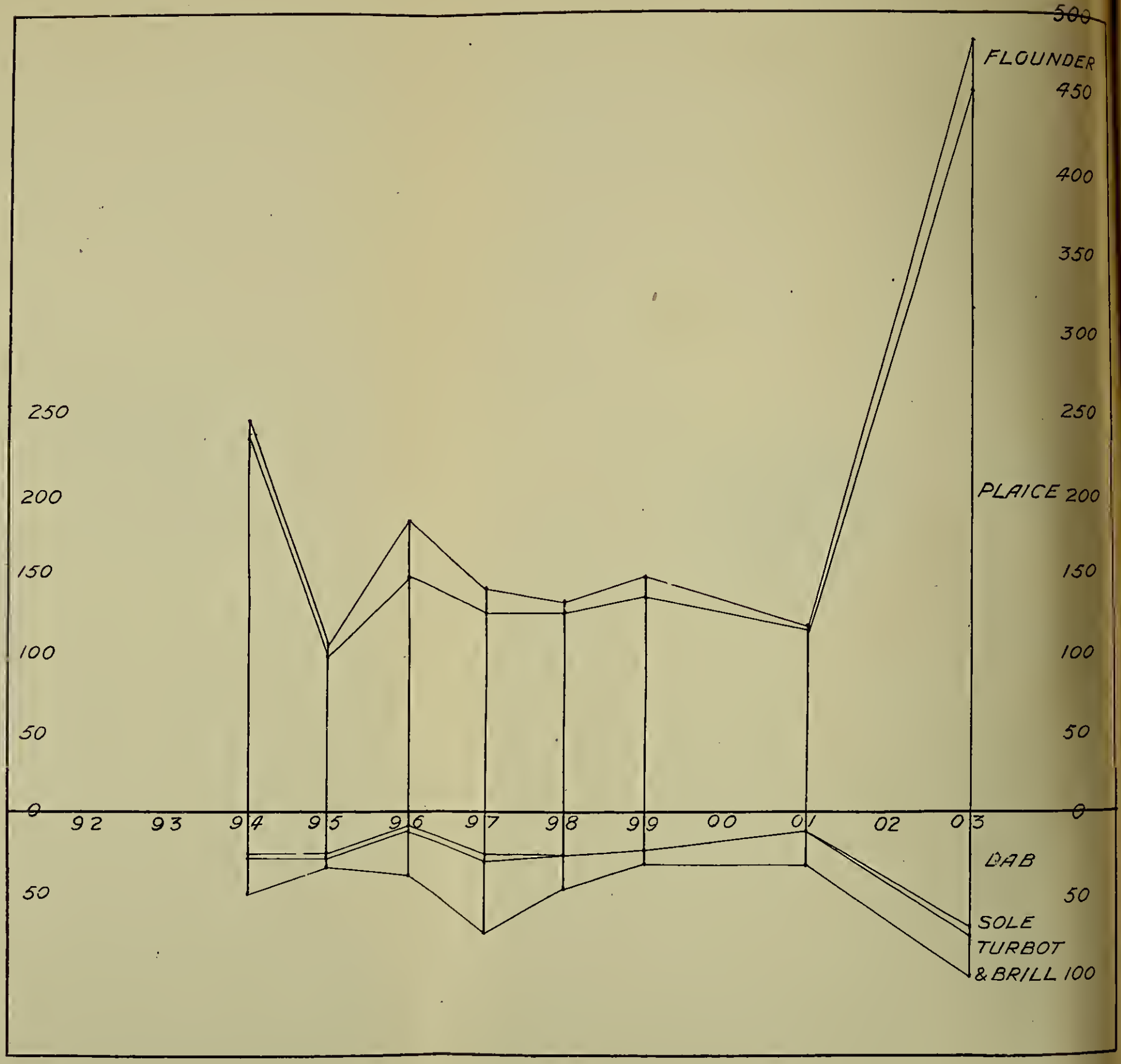


CHART IV.

Skate Roads.—The average catch of marketable fishes for each year from 1894 to 1903 (except 1900, and also 1902, when no experiment was made).

The charts have been constructed in the following manner :— The vertical line for each year represents the total average catch of flat fishes. It is divided by a horizontal line into two portions. The upper part of the line belongs to the plaice, to which is added in each case the number of flounders. The lower part of the line shows in similar manner the dabs, and in this case each line is also made to indicate the numbers in succession of soles and of turbot and brill. The lower one of the two upper curves therefore shows the variation for all the years represented in the catches of plaice. The curve immediately below the horizontal line in the same way represents the variations in the catches of dabs. A comparison of the charts is interesting moreover as showing even better than was attempted in the last report the character of each bay as regards the proportion of the flat fishes present in each, at all events during the summer months. At Cambois Bay, for example, the dabs and plaice are and have been for practically the whole series of years in about equal numbers. Druridge Bay is almost exactly like Cambois Bay, but in the latter case the more modern success of the dabs is much more apparent. At Alnmouth Bay the slightly larger proportionate number of plaice is evident, and at the same time the great diminution of these during the past two years. Before 1902 the proportion of plaice to dabs may be said to have been 3/2 ; but in 1902 and 1903 these two forms have by a diminution, especially in the numbers of the plaice, come to occupy as they do in the bays to the south about an equal place as regards numbers. At Skate Roads, on the other hand, plaice are conspicuously predominant. The proportion in relation to dabs is about 1/5 to 1/7. This station differs from the others too in the fact that the prime fish are for the most part turbot and brill. At these latter the most prevalent prime fish is the sole.

The charts also indicate the progress made during the period. It is at once apparent that the more southern stations have benefited to the greatest extent. There is little need to put into words what the charts plainly indicate for Cambois Bay and for Druridge Bay. A similar improvement is evident for Blyth Bay likewise, though for the reason that for a few years the experiments have been incomplete for that bay, the results have not been charted. Alnmouth Bay was also clearly improving in the numbers of flat fishes up to 1901, since which period it has suffered, especially in the number of plaice. This year, in fact, the average return for plaice is the lowest we have had to record for that bay since the experiments

began. The reason for this is not at all clear. Skate Roads gave for about eight years a slight downward tendency, but it may be said to have been on the whole fairly stationary. This year, however, it has, as has already been pointed out, given us a record which will be very hard to beat.

One of the most remarkable features of the season's operations, however, was the large returns for soles. Every station participated in the increase, but Cambois Bay seemed this season to be particularly favoured. It is a pity that the inshore fishermen do not make any attempt to catch soles nowadays. At a time when Arenicola (the lugworm) and Nereis were far more extensively used in the district with small hooks, soles used to be caught, and often in good numbers. If the fishermen realised that this valuable fish was again to be had in numbers it would no doubt tempt many of them to return to the practice of a generation ago.

From a consideration of the results for the season we are thus in a position to say that the condition of the inshore waters, as regards the numbers of the fishes, is quite satisfactory. The Committee's district is to-day richer in the important fishes than it was when the experiments were started twelve years ago. The higher average which we pointed out characterised the latter half of the period is being maintained.

DETAILED ANALYSIS OF THE FIRST HAUL.

The figures we have published under this head every year since 1899, and to which we now add the subjoined tables from this year's work, serve to show that the inshore waters are subject to a good deal of variation in the distribution of the smaller forms. On certain days quite a large number may be caught, and then are seen to run into natural assemblages pointing to stages in growth, and on other days very few indeed are obtained. An analysis of the figures from year to year does not yet suggest the influences which bring about the variation. That tide has something, and perhaps a great deal to do with it, is more than probable, and it would doubtless prove of interest to consider the results from that point of view. In the meantime, however, we desire merely to draw attention to the fact, and to state in a few words the nature of the variations we have up to the present time observed, confining our attention at present to plaice.

1899. Up to August the small sizes were very few in number, but during August and September they became more plentiful, giving a maximum around 7·5 in. at Skate Roads at the beginning of the month, and later of 7 in. at Druridge, and of 6 in. at Cambois and at Alnmouth.

1900. Slightly larger numbers were got at the early part of the season, indicating stages at Druridge of 7 in. and also of 12 and 15 in., of 7 to 8 in. at Alnmouth and Blyth. On 25th July, at Alnmouth, there was a small peak at 9 in., and Skate Roads furnished, on August 6th, a large assemblage varying between 4 and 10 in., pointing most distinctly to a stage averaging 7 in. On September 17th the same bay with less fish gave maxima at 6 and 8 in. Between these dates Alnmouth and Blyth agree in suggesting stages of 6 and 9 in.

1901. In striking contrast to the two previous years, it was at the beginning of the season that the small examples were present in the largest numbers, but only in so far as the northern bays were concerned. On June 10 and June 26 and 28 Skate Roads presented a large number of plaice of and about 6 in., and it is worthy of note that at Goswick on the latter date the small plaice were nearer 5 in. in size for the most part. Skate Roads was visited again on August 6th, and plainly the plaice were then less numerous at the stages we are considering, and the sizes appeared to be grouped at and about 5 and 12 in. Druridge Bay was visited four times during the season, but the returns were of the paltriest kind at all the times

TABLE III.

SKATE ROADS, June 25th, 1903 (1 hour.)

INCHES.

	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total.
Plaice ...	...	1	5	7	8	9	13	16	13	7	...	...	...	...	...	...	...	79
Dab ...	...	...	...	1	5	3	2	2	1	...	...	...	...	...	...	...	...	14
Flounder...	...	...	...	...	2	1	2	1	...	1	1	...	...	...	...	...	...	8
																		101

GOSWICK BAY, June 26th (45 minutes.)

Plaice ...	...	...	5	8	1	...	2	1	...	1	...	...	...	...	...	...	...	18
Dab ...	...	...	...	2	...	...	1	...	...	...	...	...	...	...	...	...	...	3
Brill ...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	...	..	...	2
Sole ...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1
Gurnard ...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1
Skate ...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Angler ...	...	...	...	...	...	...	...	...	3	1	...	...	2	...	...	2	...	8
																		34

SKATE ROADS, June 26th (1 hour 10 minutes.)

Plaice ...	...	...	2	11	6	10	12	13	11	6	2	1	...	...	...	...	...	74
Dab ...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	2
Turbot ...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1
Brill ...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Flounder...	...	...	...	1	1	2	2	...	...	1	...	...	1	...	...	...	...	8
																		86

ALNMOUTH BAY, July 1st (1 hour.)

Plaice ...	...	...	10	14	3	4	4	4	6	2	...	2	1	...	...	...	...	46
Dab ...	...	...	7	6	9	10	3	2	...	...	...	...	.	...	...	...	...	37
Turbot ...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	2
Sole ...	...	...	...	...	...	1	1	4	1	1	...	...	...	...	...	...	...	8
Flounder...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	2
Gurnard ...	...	...	...	...	4	1	...	...	...	...	...	...	...	...	...	...	...	5
Angler ...	...	...	...	...	...	...	1	...	1	...	..	...	...	...	...	...	1	3
																		103

CAMBOIS BAY, July 9th (1 hour.)

Plaice ...	...	...	3	6	3	3	...	1	2	3	1	...	...	...	...	...	...	22
Dab ...	...	...	5	8	11	5	...	1	1	...	...	...	...	...	...	...	...	31
Sole ...	...	...	...	...	...	5	4	6	6	...	...	...	...	...	...	...	...	21
Flounder...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1
Skate ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
																		76

DRURIDGE BAY, July 15th (1 hour.)

Plaice ...	...	1	9	10	1	1	2	7	9	7	3	...	1	...	...	...	...	51
Dab ...	...	...	7	34	18	15	6	2	2	...	...	...	...	...	...	...	...	84
Turbot ...	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	2
Brill ...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1
Sole ...	...	...	...	...	1	1	...	2	7	1	...	...	...	...	...	...	...	12
Flounder...	...	...	...	1	2	1	...	1	...	...	...	...	...	...	...	...	...	5
Gurnard ...	...	...	...	...	4	6	9	9	6	1	1	...	...	...	...	...	...	36
Angler ...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1
Weever ...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
																		193

TABLE III.—CONTINUED.

BLYTH BAY, July 23rd (1 hour.)

INCHES.

	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total.
...ice ...	...	...	4	7	19	16	9	12	4	5	...	...	...	...	...	...	...	76
...b ...	...	...	3	41	41	13	3	...	...	...	...	...	...	...	...	...	...	101
...le ...	...	...	...	...	...	2	2	...	1	...	...	...	...	...	1	...	...	6
...under...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1
...rnard ...	...	...	4	3	2	...	...	...	1	...	...	...	...	...	...	...	...	10
...gler ...	...	...	...	1	1	...	1	1	1	...	1	...	3	1	1	...	...	11
																		205

SKATE ROADS, August 4th (1 hour 25 minutes.)

...aice ...	1	4	29	28	23	16	9	2	1	...	...	...	...	...	...	...	...	113
...ib ...	...	...	2	8	11	6	6	5	3	3	...	...	...	...	...	...	...	44
...rbot ...	...	...	...	...	...	...	1	1	1	1	...	...	...	...	...	...	...	4
...ill ...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...	...	...	2
...le ...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	2
...ounder...	...	...	...	...	...	...	1	...	..	...	...	...	...	..	...	...	...	1
...rnard ...	...	..	...	2	2	1	2	1	..	...	...	...	...	...	...	...	...	8
...gler ...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	..	1
																		175

DRURIDGE BAY, August 12th (1 hour.)

...aice ...	...	...	1	2	1	...	1	6	4	3	9	2	1	...	...	...	...	30
...ib ...	...	...	5	37	73	36	17	4	1	...	...	1	...	...	...	...	...	174
...rbot ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
...le ...	...	...	...	...	...	...	...	2	2	...	1	...	1	1	...	...	...	7
...rnard ...	...	...	...	1	...	11	16	7	13	5	1	1	...	...	...	...	...	55
...gler ...	...	..	...	...	...	...	1	...	...	...	...	1	...	...	...	...	...	2
																		269

ALNMOUTH BAY, August 19th (1 hour.)

...aice ...	...	4	5	3	4	5	2	5	2	...	...	...	...	...	...	...	...	30
...ab ...	1	...	3	24	23	11	4	1	1	...	...	...	...	...	...	...	...	68
...rbot ...	...	...	...	...	...	...	...	...	...	...	2	1	...	...	...	...	...	3
...le ...	...	...	...	...	...	1	...	2	6	1	...	...	...	1	...	...	...	11
...lounder...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1
...urnard ...	...	...	1	23	23	10	3	3	...	2	...	...	1	...	...	...	...	66
...ngler ...	..	...	...	...	1	...	...	..	...	1	2	2	2	1	...	...	...	9
																		188

CAMBOIS BAY, August 26th (1 hour.)

...laice ...	...	1	3	5	12	9	3	4	1	...	...	...	...	...	...	...	...	38
...ab ...	...	6	12	59	20	10	6	1	2	...	...	...	...	...	...	...	...	116
...ole ...	...	...	...	...	...	1	...	2	2	1	1	...	...	1	...	...	...	8
...Whiting ...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1
...ythe ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(28 in.)		1
...urnard ...	...	2	1	8	1	4	3	2	1	1	...	...	...	...	...	...	...	23
...kate ...	..	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1
...ngler ...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1
																		189

BLYTH BAY, September 2nd (40 minutes.)

...laice ...	...	...	1	1	...	4	6	14	24	11	3	...	...	...	...	...	...	64
...ab ...	...	...	...	5	9	6	1	...	1	...	...	...	...	...	...	...	...	22
...urbot ...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	2
...ole ...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	2
...lounder...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	2
...urnard ...	...	...	...	...	...	...	1	5	3	1	...	1	...	...	...	...	...	11
...ngler ...	...	...	...	...	...	...	...	...	..	...	...	...	...	1	...	...	...	1
																		104

DRURIDGE BAY, September 9th (65 minutes.)

...laice ...	...	...	1	1	4	6	4	7	3	3	2	...	...	1	...	...	...	32
...ab ...	...	...	...	24	27	13	10	3	...	...	1	...	...	...	...	...	...	78
...urbot ...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	2
...ole ...	...	...	...	...	...	2	3	1	1	..	1	2	...	1	...	...	...	11
...urnard ...	...	...	...	...	3	3	1	1	3	1	...	...	...	...	...	...	...	12
...ngler ...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	2
...kate ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(26 in.)		1
																		138

except the last, on which occasion there was evidence of a grouping about 7 and more distinctly about 10 in. Almouth Bay gave evidence of stages of 6 in. and of 9 to 10 in. on August 14, but on July 24 too few were caught to indicate anything. Cambois indicated 6 to 7 in., both on July 3 and August 28, but was unproductive on September 4.

1902. The results may be briefly stated as follows :—In June Skate Roads gave a stage of 6 in., and on July 30 one of 7·25 in.; in September these had considerably diminished. Cambois offered at the end of June and in July a stage of 7·5 in. The maxima as shown at Almouth were on July 9, 8 in.; July 30, 6 and 8 in.; and on August 27th 9 in. Druridge just indicated on July 16th 9 and 12 in., and on August 20th 9½ and 12 in. Blyth gave maxima at 6 and 9½ in. on September 11.

1903. This was a poor season on the whole as regards the smaller plaice. Skate Roads on June 25 and 26 pointed to stages of about 7 and 11 in. Goswick this year was very disappointing, in striking contrast to 1900, when it was last visited. Skate Roads on August 4 was more richly supplied with a group centering in 7 in. The other stations were poorly represented, the maxima indicated were 6 to 7 in. at Druridge in July, and 12 in. at Blyth on September 2.

The foregoing statements show at all events that the seasons are very different as regards the supplies of the smaller sizes of plaice. It is clear, moreover, that the stations do not at the same time present the same stages of growth. It is not likely that the results are altogether due to the well-known variation in the rate of growth, but that there is a migration in a more or less constant direction, subject however to seasonal variation, and on this it is to be hoped the experiment we have entered upon in the marking of this form may shed some light.

THE FOOD, SEX, AND DEGREE OF MATURITY IN THE FISHES.

The following tables give the results of the examinations of selected examples of the fishes caught at the trawling excursions. It presents, as last year, the weight in the majority of cases in relation to size. It will be seen that, as has usually been the case, Mollusca formed the chief item in the list of food of the plaice, and that in the form of the Razor Shellfish it also contributed to the

diet of the dab, which diet however, as on former occasions, consisted for the most part of the Livid Swimming Crab. In addition to the other forms tabulated, and which present nothing worthy of further notice at the present time, the following are interesting :— At Holy Island one of the number of cod caught by the fishermen on the line was measured and weighed, the figures being 31 in. and 14½ lb., and this size appeared to be very common. This particular cod had been feeding upon an edible crab and a gurnard. The anglers observed during the season were feeding upon dabs, plaice, weevers, whitings, and sand eels.

TABLE IV.—PLAICE.

Date and Place.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
	In.	Oz.			In.		
July 1st ...	16 × 9¾	26	F.	—	1¾	*Tellina tenuis*	... ..
(Alnmouth)	11¾ × 6¾	10	F.	—	1	Empty	.. ...
	10¼ × 5½	7	M.	—	½	,, ...	.....
July 15th ...	16½ × 9¾	28	F.	—	2¼	*Tellina tenuis and Donax trunculus*	.....
(Druridge)	14 × 8¼	16	F.	—	1½	,, ,,	.....
	12 × 7¼	10½	M.	—	½	*Tellida tenuis*	.. ...
July 23rd ...	12½ × 7¼	13	M.	—	⅜	Empty	.....
(Blyth)	11¼ × 6½	8	M.	—	3/16	Molluscan foot...	.. ...
	9¾ × 5¾	4½	F.	—	5/8	Empty	.....
Aug. 4th ...	12½ × 7½	13	M.	—	⅜	Small sand eels	.....
(Skate Roads)	11½ × 7¼	9	M.	—	¼	,, ,, ...	.....
	10¾ × 6	7½	F.	—	1⅛	Annelid...	.....
Aug. 12th ...	14½ × 8¼	22½	F.	—	1⅜	*Donax trunculus*, annelid ...	... ..
(Druridge)	14¼ × 8½	20	F.	—	1½	Empty	.. ...
	11 × 6½	8	M.	—	5/8	,, ...	.....
Aug. 19th ...	13¾ × 8	17	M.	—	¾	*Tellina tenuis*	.....
(Alnmouth)	13 × 7¾	16	M.	—	¾	,, ...	.....
	11¾ × 6¾	10	M.	—	¼	Solen	.....
Aug. 26th ...	17¼ × 9½	32½	F.	+	3¾	*Donax trunculus*	.....
(Cambois)	15 × 9	25	F.	—	1¾	Empty	.....
	13½ × 7½	14½	F.	—	1⅝	,, ...	.....
Sept. 2nd ...	14¾ × 8¼	...	F.	—	1¼	Sand eels	.....
(Blyth)	12½ × 7½	...	M.	—	¼	,, ...	.....
	11¼ × 6½	...	M.	—	5/8	Annelid	.....
Sept. 9th ...	11¼ × 6½	...	F.	—	1⅛	Annelid	.....
(Druridge)	17¾ × 10⅜	...	F.	+	3¾	*Donax trunculus*	.....
	15½ × 9¼	...	F.	—	1⅝	,, ...	.....

Table IV. Continued.—TURBOT.

d	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
	In.	Oz.			In.		
...	$14\frac{1}{2} \times 10\frac{1}{2}$	35	M.	—	$1\frac{3}{8}$	Empty	.....
th)	18 ×14	76	F.	+	$2\frac{5}{8}$	,, ...	.....
	13 ×$10\frac{1}{4}$	27	M.	—	$1\frac{1}{4}$	Dabs (?)—much digested ...	.....
...	14 ×11	33	F.	—	$1\frac{1}{2}$	Sand eel	.....
ge)	$15\frac{1}{2} \times 13$	$50\frac{1}{2}$	F.	—	$1\frac{3}{4}$	Empty	.....
...	$11\frac{1}{4} \times 8\frac{1}{4}$	$17\frac{1}{2}$	M.	—	$\frac{3}{4}$	Empty	.....
)	13 × $9\frac{3}{4}$	$25\frac{1}{2}$	M.	+	1	,, ...	.....
	$13\frac{1}{4} \times 10\frac{1}{4}$	29	M.	—	$1\frac{1}{2}$	Sand eels	.....
...	13 × $9\frac{1}{2}$	$26\frac{1}{2}$	F.	—	$1\frac{3}{8}$	Sand eels (small)	.. ...
ads)	$12\frac{1}{4} \times 9\frac{1}{4}$	$22\frac{1}{2}$	M.	—	$\frac{3}{4}$	Empty	.....
	14 ×$10\frac{3}{4}$	$39\frac{1}{2}$	M.	—	$1\frac{1}{4}$	Dab ($2\frac{1}{4}$ in.)	... ..
...	18 ×14	64	F.	+	$2\frac{1}{2}$	Sand eel	.. ...
ge)	— ×$12\frac{1}{4}$	48	F.	+	$2\frac{1}{4}$	,, ...	Tail absent
...	15 ×11	48	F.	+	$1\frac{1}{2}$	Empty	.. ...
ith)	$14\frac{1}{4} \times 11$	42	M.	—	1	,, ...	.....
	$14\frac{3}{4} \times 10\frac{1}{2}$	40	M.	—	$1\frac{1}{4}$	*Agonus cataphractus*	.....
...	$14\frac{1}{4} \times 9\frac{3}{4}$	37	F.	—	$1\frac{5}{8}$	Five 3 in. whitings	.....
is)	16 ×$12\frac{3}{4}$	51	F.	—	2	Nine ,, ...	.. ...
	14 ×$11\frac{1}{2}$	38	M.	+	$1\frac{1}{8}$	Six ,, ...	.....
...	$14\frac{1}{2} \times 11$	...	M.	+	$1\frac{1}{8}$	Digested fish	.....
...	$14\frac{1}{8} \times 10\frac{1}{2}$	...	M.	—	$1\frac{1}{8}$	Digested fish	.....
ge)	$13\frac{7}{4} \times 10\frac{3}{4}$	...	M.	—	$1\frac{1}{8}$	Empty	.....

Table IV. Continued.—DAB.

Date and Place.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
	In.	Oz.			In.		
July 1st ...	$12\frac{3}{4} \times 6\frac{1}{2}$	12	F.	—	$2\frac{1}{4}$	Solen foot	.. ...
(Alnmouth)	$10\frac{1}{4} \times 5\frac{1}{2}$	7	F.	—	$\frac{7}{8}$	Empty	.....
	$9 \times 4\frac{3}{4}$	5	F.	—	$\frac{3}{4}$	,, ...	.....
July 15th ...	$11\frac{3}{4} \times 6$	$8\frac{1}{2}$	F.	—	$1\frac{1}{2}$	Empty	.....
(Druridge)	$10\frac{3}{4} \times 6$	7	F.	—	2	Solen	.....
	$10\frac{1}{2} \times 5\frac{3}{4}$	6	F.	—	$\frac{7}{8}$	Empty	.....
July 23rd ...	$10 \times 5\frac{1}{2}$	6	F.	—	$\frac{5}{8}$	Sand eel	.....
(Blyth)	$10 \times 5\frac{1}{2}$	$5\frac{1}{2}$	F.	—	$\frac{5}{8}$	Empty	.....
	$8\frac{1}{2} \times 4\frac{1}{2}$	3	F.	—	$1\frac{1}{4}$	,, ...	.....
Aug. 4th ...	$14\frac{1}{2} \times 7\frac{1}{2}$	17	F.	—	$2\frac{1}{4}$	*Portunus holsatus*	.....
(Skate Roads)	$11\frac{1}{2} \times 6\frac{1}{4}$	10	M.	+	$\frac{5}{8}$	Solen (with shell)	.....
	$10 \times 5\frac{1}{4}$	6	F.	—	$\frac{5}{8}$	*Portunus holsatus*	.....
Aug. 12th ...	$11\frac{1}{4} \times 6\frac{1}{2}$	10	F.	—	$1\frac{1}{4}$	*Portunus holsatus*	.....
(Druridge)	$10 \times 5\frac{1}{2}$	6	F.	—	$1\frac{5}{8}$	*P. holsatus* and Solen ...	.. ...
	$10 \times 5\frac{1}{4}$	6	F.	—	$\frac{3}{4}$	Animal tissue	.....
Aug. 26th ...	13 × 7	14	F.	—	$2\frac{1}{4}$	*P. holsatus* & Molluscan tissue	.....
(Cambois)	$11\frac{1}{2} \times 6\frac{1}{2}$	12?	M.	—	?	*Portunus holsatus*	.....
	$10 \times 5\frac{1}{4}$	6?	F.	—	$1\frac{5}{8}$	Empty	.....
Sept. 2nd ...	$9\frac{1}{4} \times 5$	...	M.	+	$\frac{3}{4}$	Empty	.....
(Blyth)	9×5	...	F.	—	$\frac{3}{4}$	Animal tissue	.....
	$9\frac{1}{2} \times 6$	...	F.	—	1	*Portunus holsatus*	.....
Sept. 9th	$11 \times 5\frac{1}{2}$	...	F.	—	$\frac{7}{8}$	Empty	.....
(Druridge)	$10\frac{3}{4} \times 5\frac{3}{4}$	...	F.	—	$1\frac{5}{8}$	,, ...	.....
	$10 \times 5\frac{1}{2}$	...	F.	—	$1\frac{1}{8}$	,, ...	.....

Table IV. Continued.—SOLE.

ıd	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
	In.	Oz.			In.		
...	$18\frac{3}{4} \times 8$	31	F.	+	9	Empty	.....
ıth)	$12\frac{1}{2} \times 5\frac{3}{4}$	11	F.	—	$3\frac{1}{2}$	Nereis	.....
	$10\frac{3}{4} \times 4\frac{1}{2}$	6	F.	—	$2\frac{3}{4}$	Empty	.....
ı ..	$13\frac{1}{4} \times 5\frac{1}{2}$	13	F.	—	$3\frac{1}{2}$	Empty	.....
ge)	$11 \times 4\frac{1}{2}$	9	F.	—	$1\frac{3}{4}$	Nereis	.. ...
	$9\frac{1}{4} \times 3\frac{3}{4}$	4	M.	—	$\frac{1}{4}$	Empty	.....
l ...	$15\frac{1}{2} \times 6\frac{1}{2}$	22	F.	+	$5\frac{1}{2}$	Empty	.....
h)	$10\frac{3}{4} \times 4\frac{1}{4}$	6	F.	—	$2\frac{3}{4}$	,, ...	.....
	11×5	$8\frac{1}{4}$	F.	—	$2\frac{1}{2}$	,, ...	... ..
...	$10\frac{3}{4} \times 4$	6	F.	—	2	Empty	.....
oads)	$11 \times 4\frac{1}{4}$	$6\frac{1}{2}$	M.	—	$\frac{1}{4}$	,, ...	.....
h ...	$16\frac{1}{4} \times 7$	$25\frac{1}{2}$	F.	+	$8\frac{1}{2}$	Sand eel	.....
lge)	$14 \times 5\frac{1}{4}$	16	F.	+	$6\frac{1}{2}$	Empty	.....
	$11 \times 4\frac{1}{2}$	$7\frac{1}{2}$	M.	—	$\frac{1}{4}$	,, ...	.....
h ..	$17\frac{3}{4} \times 7$	30	F.	+	$7\frac{1}{2}$	Empty	.....
ois)	20×8	36	F.	+	8	,, ...	.....
	$18\frac{1}{4} \times 7\frac{3}{4}$	32	F.	+	7	,, ...	.....
d ..	$13\frac{1}{4} \times 5\frac{1}{4}$	...	F.	—	3	Empty	.. ...
ı)	$10\frac{1}{2} \times 4\frac{1}{2}$	...	F.	—	$2\frac{1}{2}$	Sand eel	.....
ı ...	$15\frac{1}{4} \times 6\frac{1}{2}$	...	F.	+	6	Sand eel	.....
dge)	$12\frac{1}{4} \times 5$	.	F.	—	$3\frac{1}{2}$	Empty	.....
	$10\frac{1}{2} \times 4\frac{1}{2}$	...	M.	—	$\frac{5}{16}$	,, ...	.....

BRILL.

h ... dge)	$16\frac{1}{2} \times 10\frac{1}{2}$	35	F.	+	$3\frac{1}{4}$	Sand eels	.....
d ... h)	$15\frac{1}{2} \times 10$	32	F.	+	$2\frac{3}{4}$	Empty	.....
ı ... oads)	$15\frac{1}{4} \times 10$	32	M.	?	?	Empty	.....
	$11 \times 7\frac{1}{2}$	12	M.	—	$\frac{1}{4}$	Sand eels (small)	.....
th outh)	$16\frac{1}{2} \times 10\frac{3}{4}$	40	F.	—	$2\frac{1}{2}$	Two weevers	.....

Table IV. Continued.—GURNARD.

Date and Place.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
	In.						
July 1st ...	$12\frac{3}{4}$	9	F.	+		Sand eel	.....
(Almouth)	$12\frac{1}{4}$	8	F.	+		*Crangon vulgaris*	.....
	$8\frac{1}{2}$	3	F.	—		Empty	.....
July 15th ...	$14\frac{1}{2}$	12	F.	+		Empty	.....
(Druridge)	$12\frac{1}{4}$	9	F.	+		Sand eel	.....
	11	6	F.	+		Empty	.....
July 23rd ..	15	16	F.	+		Sand eel	.....
(Blyth)	13	$10\frac{1}{2}$	F.	+		,, ...	.....
	10	5	F.	+		,, (?)	.....
Aug. 4th ...	13	$10\frac{1}{2}$	F.	+		Sand eels & *P. holsatus* ...	.....
(Skate Roads)	$13\frac{1}{4}$	11	F.	+		Sand eel	.....
	12	8	F.	—		*Portunus holsatus*	.....
Aug. 26th ...	13	11	F.	+		Sand eel	.....
(Cambois)	$14\frac{1}{2}$	14	F.	+		Three $3\frac{1}{2}$ in whitings ...	.....
	$11\frac{3}{4}$	$6\frac{1}{2}$	M.	+		Annelid and animal tissue ...	.....
Sept. 2nd ...	$14\frac{1}{2}$	...	F.	+		Empty	.....
(Blyth)	12	...	F.	+		,, ...	.....
Sept. 9th ...	14	...	F.	+		*Portunus holsatus*	.....
(Druridge)	$14\frac{3}{4}$	...	F.	+		Empty	.....

BIOLOGICAL INVESTIGATIONS.

The following table indicates the general nature of the plankton obtained at the trawling excursions. Pleurobrachia was very common during the summer, and formed the main portion of the large catches of June 25th, July 1st, and August 12th. The floating ova of the weever were obtained at all the stations almost from the end of June until the beginning of September.

TABLE V.

Place and Date.	Apparatus and Quantity.	Organisms.
Kettle Inner Farnes... June 25.	Small surface net in current 3 c.c.	Medusoids, Beroe ** Sagitta ** Copepoda *** Plutei, Zoeae Cladocera * Barnacles; Cypris stage, cast cuticles Amphipods
Skate Roads. ... June 25.	Large surface net 40 c.c.	Ova of Weever **, of Gurnard 1 Medusoids * Pleurobrachia *** Anomalocera
Harbour. Holy Island June 25.	Large surface net near bottom in the current	*Paratylus swammerdami* *Macromysis flexuosa*
Almmouth Bay ... July 1.	Net on beam ½ hour	Pleurobrachia *** Leseuria ** *Hyperoche tauriformis* 2 females 1 male, juv.
Druridge Bay .. July 15.	Surface net 1 hour 5 c.c.	Ova of Weever * Lumpsucker embryo Phiallidium, Pleurobrachia Weed debris
	Small net on beam 1 hour 5 c.c.	Dinoflagellates * Phiallidium Copepoda ** Cladocera * *Paratylus swammerdami* *Schistomysis spiritus* Zoeae Veligers
Skate Roads ... Aug. 4.	Surface net 1½ hour 2 c.c.	Ova of Weever, Larval Flounder Pleurobrachia. Aurelia Copepoda * *Gammarus locusta* *Podocerus falcatus* *Hyperoche tauriformis* Zoeae Megalopoda

TABLE V.—CONTINUED.

Place and Date.	Apparatus and Quantity.	Organisms.
Skate Roads ... Aug. 4.	Small net on beam $1\frac{3}{4}$ hour 2 c.c.	Ova of Weever Annelid jv. Copepoda *** Cladocera * Paratylus jv Apherusa jv. Zoeae Veligers
Druridge Bay ... Aug. 12.	Large surface net $\frac{3}{4}$ hour 350 c.c.	Ova of Weever *** of Dab * Rockling, 33 mm. *Nerophis aequorea*, jv. Pleurobrachia *** Bougainvillea * *Metopa alderi* *Paratylus uncinatus* Zoeae
	Small net on beam $\frac{3}{4}$ hour	Ova of Weever * Medusoids Copepoda * *Paratylus uncinatus* Veligers
Alnmouth Bay ... Aug. 19.	Large surface net 1 hour 5 c.c.	Ova of Weever *** Gurnard * Pleurobrachia Sagitta Copepoda * Zoeae Megalopoda *Hyperoche tauriformis* Appendicularia
	Small net on beam 1 hour $1\frac{1}{2}$ c.c.	Copepoda ** Zoeae * Ophiuroid jv. * Veligers * Appendicularia *
Cambois Bay ... Aug. 26.	Large surface net 1 hour 2 c.c.	Ova of Weever ** Pleurobrachia ** Copepoda Zoeae, Megalopoda **
	Small net on beam 2 hours 2 c.c.	Ophiuroid jv. Copepoda Ostracoda *Paratylus uncinatus* *Pseudocuma cercaria*
Blyth Bay ... Sept. 2.	Large surface net $\frac{1}{2}$ hour	Ova of Weever * Pleerobrachia ** Aurelia *Gammarus locusta* *Hyperia galba* jv. Zoeae ** Megalopoda ***
Druridge Bay ... Sept. 9.	Large surface net 1 hour	Embryo Angler Pleurobrachia * Sagitta *** Cladocera ** *Hyperoche tauriformis* Zoeae Megalopoda

In addition to the above, the annual dredging excursion of the Northumberland Coast Club gave us again the opportunity to carry out some dredging operations off the Tyne. As we may next year be in the position to greatly extend the work we have done in this direction, we propose withholding the records until we have the hoped for further material.

We received on July 24th, from Mr. J. Douglas, Beadnell, a quantity of the ova of the Angler enclosed in their peculiar gelatinous investment. Mr. Douglas said that the spawn was got in the herring nets about 15 miles out, and must have been floating about five fathoms below the surface.

Captain Cappelman sent at our request, a bag of the Zoophyte material which he obtained in his trawl net 6 miles off Whitby, on 27th April. It may be taken as representative of the Zoophytes captured by the commercial trawler when fishing on the harder grounds.

The gathering was analysed into the constituent species, and the resulting heaps were placed side by side and photographed. The picture is here reproduced, and serves to illustrate the proportional

Analysis of Zoophytes from six miles off Whitby.

occurrence of the commoner Sertularians and Flustras in such a situation as this, and indeed on the same kind of ground off our coast in general.

The large heap with the foot rule placed against it is *Hydrallmania falcata*, and to the right the four smaller heaps in succession are, 1, *Sertulia abietina*; 2, the Antennularias; 3, *Sertularia filicula*; and 4, *Thuiaria thuia*. To the left is *Flustra foliacea*, and in front are *Halecium halecinum* and *H. muricatum*; the long strands to the right were found to belong to the Hydrallmania group also. Other species were poorly represented, but there were as usual Polyzoan and Sertularian messmates, attached especially to Hydrallmania and *S. abietina*, and in the case of the former there also were several clusters of the eggs of Montagu's Sucker.

CRABS AND LOBSTERS.

The following tables exhibiting in detail the catches of crabs and lobsters ie season have been prepared by Mr. J. Douglas, Beadnell, and Mr. G. us, Sea Houses. We hope to have the opportunity of discussing the es for a series of years, and in the meantime content ourselves by drawttention to the large returns for lobsters so characteristic of the district year.

TABLES SHOWING THE CATCHES OF CRABS AND LOBSTERS FOR 1903.

TABLE I.—BY MR. J. DOUGLAS, BEADNELL.

CRABS—1903.

	January.	February.	March.	April.	May.	June.
in ms ...	... 28 ...	... 28 ...	... 20 ...	... 16 ...	10 to 16	3 to 16
'ots...	... 100 ...	... 100 ...	... 150 ...	... 250 ...	... 250 ...	... 250 ...
s.	Numbers.	Numbers.	Numbers.	Numbers.	Numbers.	Numbers.
...	...	...	...	120	160	60
...	...	...	200	...	98	24
...	...	300	...	318	...	20
...	...	...	400	60	120	68
...	160	500	100	...	138	20
...	80	240	200	336	...	76
...	...	200	...	60	248	...
...	200	...	...	128	96	70
...	...	300	100	320	86	26
...	...	...	200	...	...	56
...	...	600	100	186	40	...
...	...	200	100	.	38	...
...	220	...	150	...	100	18
...	300	400	100	...	20	...
...	...	...	...	...	34	80
...	...	500	50	...	22	...
...	...	400	80	...	...	...
...	...	300	200	...	80	...
...	300	...	150	...	62	100
...	250	400	200	178	68	126
...	...	...	...	...	10	...
...	100	...	...	320	20	120
...	200	...	240	428	28	60
...	...	...	200	166	...	20
...	...	...	240	108	60	70
...	...	300	100	...	28	66
...	250	...	...	130	30	48
...	...	420	400	86	34	...
...	200	...	...	168	21	...
...	...	...	...	160	40	...
...	...	...	400	...	...	...
	Days. Numbers.	Days. Numbers.	Days. Numbers.	Days Numbers.	Days. Numbers	Days. Numbers.
.s ...	11 2,260	14 5,060	21 3,910	17 3,272	25 1,681	19 1,128
ge per y ...	205·5	361·4	186·2	192·5	67·2	59·4

LOBSTERS.

	April.	May.	June.
Number of Pots	250	250	250
Number of Lobsters... ...	130	749	228
Number of Berried Hens ...	9	133	54
Number of Small returned ...	3	51	32

TABLE II.—By Mr. G. FAWCUS, Sea Houses.

CRABS—1903.

Date.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Hens.	Total Number of Hard.	Number of Soft.	Depth in Fathoms.
Feb. 9	52	90	80	...	170	7	25
11	52	106	112	...	218	9	,,
12	52	93	104	...	197	5	,,
16	104	200	150	...	350	12	,,
18	104	180	160	...	340	9	,,
20	104	170	150	...	320	10	,,
25	52	110	90	...	200	8	,,
28	104	100	200	...	300	12	,,
8 days	...	1049	1046	...	2095	72	...
Average	per day	131	131	...	262	9	...
Mar. 2	104	100	80	...	180	6	25
5	104	130	76	...	206	8	,,
7	104	90	80	...	170	4	,,
10	104	80	40	...	120	6	,,
14	104	100	30	...	130	2	,,
17	104	123	90	...	213	4	,,
20	104	112	60	...	172	3	,,
23	104	145	112	...	257	6	,,
25	104	211	165	...	376	4	,,
27	104	175	120	...	295	1	,,
31	144	240	130	...	370	8	12 to 25
11 days	...	1506	983	...	2489	52	...
Average	per day	137	89·3	...	226·3	5	...
April 1	144	160	240	1	401	12	12 to 25
2	144	130	268	1	399	7	,,
3	144	60	140	...	200	14	,,
6	144	80	160	...	240	6	,,
9	144	108	170	...	278	9	,,
11	144	120	180	...	300	5	,,
20	172	180	160	1	341	9	10 to 20
22	172	300	290	...	590	7	,,
23	172	309	300	...	609	8	,,
24	172	206	200	...	406	10	,,
25	172	200	190	...	399	4	,,
27	172	209	160	1	361	2	,,
29	172	220	260	...	480	3	,,
13 days	...	2282	2718	4	5004	96	...
Average	per day	175·7	209	0·3	385	7·4	...

TABLE II. (CONTINUED.)—CRABS.

Date.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Hens.	Total Number of Hard.	Number of Soft.	Depth in Fathoms.
May 2	172	190	230	...	420	5	10 to 20
4	172	100	180	...	280	4	,,
8	172	80	100	...	180	1	,,
9	172	35	45	...	80	3	,,
11	172	50	40	...	90	4	2 to 15
12	172	30	20	...	50	1	,,
13	172	20	16	...	36	5	,,
14	172	40	30	...	70	2	,,
15	23	3	2	...	5	3	6
16	172	60	40	...	100	2	2 to 15
18	177	50	40	...	90	4	2 to 8
19	177	25	35	...	60	1	,,
20	177	35	40	...	75	...	,,
21	177	55	43	...	98	2	,,
22	177	20	18	1	39	...	,,
23	177	40	30	...	70	...	,,
25	177	50	20	...	70	...	,,
26	177	30	25	...	55	...	,,
27	177	23	20	...	43	...	,,
28	177	32	22	...	54	...	,,
29	177	30	28	...	58	...	,,
30	177	42	31	...	73	...	,,
22 days	...	1040	1055	1	2096	37	...
Average	per day	47.3	48	...	95.3	1.7	...
June 1	92	40	32	1	73	1	2 to 8
2	145	42	18	...	60	...	,,
4	80	35	16	1	52	...	,,
6	172	48	23	...	71	...	,,
8	172	41	32	1	74	...	,,
10	172	21	35	...	56	...	,,
12	172	34	28	...	62	...	,,
13	172	36	21	1	58	1	,,
15	172	42	35	...	77	2	,,
19	172	90	76	...	166	3	,,
20	172	125	164	...	289	2	,,
11 days	...	554	480	4	1038	9	...
Average	per day	50.3	43.7	0.3	94.3	1	...

TABLE II. (CONTINUED.)—LOBSTERS.

Date.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Hens.	Total Number.	Depth in Fathoms.
Feb. 18	104	1	...	...	1	25
April 1	144	2	1	...	3	12 to 25
2	144	...	1	...	1	,,
3	144	1	...	...	1	,,
9	144	...	1	1	1	,,
20	172	...	1	...	1	10 to 20
25	172	1	...	1	1	,,
29	172	...	1	...	1	,,
8 days ...		5	5	2	10	...
May 9	172	...	1	...	1	10 to 20
11	172	8	13	4	25	2 to 15
12	172	6	11	4	21	,,
13	172	9	8	4	21	,,
14	172	8	6	3	17	,,
15	23	2	3	2	7	6
16	172	10	12	...	22	2 to 15
18	177	8	11	4	23	2 to 8
19	177	6	5	3	14	,,
20	177	11	12	4	27	,,
21	177	18	15	5	38	,,
22	177	12	14	4	30	,,
23	177	10	14	7	31	,,
25	177	8	6	5	19	,,
26	177	16	15	5	36	,,
27	177	17	19	5	41	,,
28	177	14	20	7	41	,,
29	177	12	16	12	40	,,
30	177	7	9	13	29	,,
19 days ...		182	210	91	483	...
June 1	92	5	4	2	11	2 to 8
2	145	6	7	3	16	,,
4	80	3	5	1	9	,,
6	172	6	8	2	16	,,
8	172	4	5	3	12	,,
10	172	2	3	1	6	,,
12	172	3	4	2	9	,,
13	172	1	3	1	5	,,
15	172	1	...	...	1	,,
19	172	5	3	1	9	,,
20	172	6	4	2	12	,,
11 days ...	...	42	46	18	106	...

THE MIGRATIONS OF CRABS.

The general facts relating to the migrations of the edible crab have long been known to fishermen, and also to those who have considered the question if only in the light of the practices of the fishermen at different seasons. These facts have been stated in previous reports; they have been clearly indicated in the returns we have published for a number of years of the catches of crabs and lobsters by Messrs. Douglas and Fawcus, and they have especially received careful and full consideration at the hands of Dr. H. C. Williamson * from the results of a large series of experiments made at Dunbar, and of a small number made on the Northumberland coast. We do not require any further experiments to be enabled to say that the larger crabs migrate to deeper water in the autumn, and return to the inshore water in the spring. But the results of the following experiments, for which we have once more to thank Mr J. Douglas, Beadnell, show that the last word has not yet been said on the subject; that, on the contrary, further work of this kind must be undertaken before we shall be in the position to state the subject of the migration of the crab in an adequate manner, and especially to discover if there is to some extent at least another migration included in the out-and-in one with which we are already familiar.

The crabs that were used by Mr. Douglas were all "casters," that is to say they were undergoing the process of hardening after a recent shedding of the old shell or cuticle. They were captured in the first instance in the crab pots, brought to the shore, labelled, and liberated at the water edge. The label, as in the case of the similar experiment with lobsters reported on last year, consisted of a brass disc stamped with a number, and tied to the great "claw" with copper wire.

Many of the crabs thus marked in December and January were recaptured off the part of the coast where they were liberated, and at depths which vary with the time of the year, in accordance with the above mentioned well-known law of migration. It will be seen, however, that the recaptured were mostly males, only three of the eleven being females.

It is in the case of the crabs liberated in October that we have to record, if scanty, extraordinary recaptures. On October 11th, 38 were liberated at Beadnell, and none were recaptured, and it is

* 1900, 18th Ann. Rep. Fish. Bd. for Scotland.

quite possible in the light of what follows that they left the district. Of the second lot of 26 liberated on October 25th, one was got on November 27th 4 miles out in 25 fathoms; another was caught on March 28th in 14 fathoms at Goswick, which is about 12 miles from Beadnell in a straight line to the north. The third recapture was made, however, on July 6th, in 15 fathoms, so far north as Portlethen, on the Kincardineshire coast of Scotland, and just about 7 miles south of Aberdeen. This is about 80 miles in a straight line from Beadnell. The label was returned to us through the Scottish Fishery Board, and we have especially to thank Dr. Williamson for his kind intermediation and for the information he furnished with regard to the recapture. This we have also had confirmed by the fisherman, Mr. John Craig, Portlethen.

Like the others it was just undergoing the process of hardening, and would have been described as a large white crab when labelled and liberated at Beadnell. Mr. Craig said the crab when he got it was an ordinary sized crab, and it was then hard.

It cannot be said then that the crabs always find their way back to the same area in returning from their winter migration. In the course of this migration the great majority evidently do not go much beyond 6 miles out, but that a proportion migrate to much greater distances from the land we have known for some time from information and specimens furnished to us by trawlers. These may in very many instances, as would appear from this evidence, be the older females. But we have an example—one of several—a male measuring only 2 15-16th in. which was said to have been caught in a trawl net in November on the North-East Bank. When we consider moreover that both the crab in question and the one obtained at Goswick, if they had not been caught would more than probably have come into "berry" at the end of 1904, we see that we are on the fringe of a question of much practical and theoretical importance, but one which, in the absence of further evidence, it would be presumptuous to do more than hint at.

We had intended repeating the experiment this autumn, but the labels we ordered arrived too late for the purpose. It is clear from the results we have obtained that it is important to have the marking done as early in the autumn as possible, or soon after casting, so as to give the crabs the whole period of the outward migration. It is not just the same thing to catch the crabs during the winter in the deep water, to mark them, and liberate them from the beach. We venture to suggest that the experiment should be taken part in by

other investigators, and if, as we have now done, a letter—in our case 'N'—be stamped on the labels in addition to the number, there would be no chance of confusion however far the crabs may migrate.

The crab which was captured at Goswick was liberated again the same night at Berwick. A small number were labelled at Cullercoats also at different times, but none of these have been returned.

THE MIGRATION OF CRABS.

LIBERATED.			CAPTURED.			
Date.	Number Male and female).	Place	Number of Label.	Date.	Sex.	Place, &c.
1902.						
Oct. 11	38	Beach...	...	.....	.. ...	None caught.
,, 25	26	Beach ..	114	1902. Nov. 27	Male	4 miles E.S.E. (25 fathoms).
			—	1903. Mar. 28	Female	Holy Island (Goswick Bay) (14 fathoms).
			125	July 6	Female	Porthlethen, Kincardineshire. ½ mile out (15 fathoms).
Dec. 15	32	Beach...	64	1903. Jan. 5	Male	4 miles E. (25 fathoms).
			34	Feb. 9	Male	4 miles E. (25 fathoms).
			62	,, 18	Female	5 miles E. (35 fathoms).
			89	,, 20	Male	4½ miles E. (30 fathoms).
			99	Mar. 13	Male	About 2 miles E. (15 fathoms).
			31	April 4	Male	2 miles E. (15 fathoms).
1903.						
Jan. 6	28	Beach...	180	Jan. 24	Male	5 miles E. (35 fathoms).
			160	Mar. 27	Male	3 miles E. (21 fathoms).
			137	May 4	Female	1 mile E. (12 fathoms).
Jan. 9	3	Beach...	170	Feb. 11	Female	4 miles E. (25 fathoms).
,, 13	10	Beach...	176	,, 4	Male	2 miles E. (15 fathoms).
,, 23	8	Beach...	...	.. ...	.....	None caught.
Total Number Liberated ... 145			Total Number Recaptured ... 14			

THE MIGRATIONS OF PLAICE.

In accordance with an arrangement made with the Committee early in the year, certain of the fishes captured at the trawling excursions were labelled and returned to the water with a view to determining their migrations, and also some facts about their rate of growth. Altogether 483 fishes were carefully measured (the majority were also weighed), labelled and returned to the sea. This year the experiment was practically confined to plaice, and the marked fish were liberated at all the trawling stations from Goswick Bay to Blyth Bay.

This part of our work during the past season thus forms an interesting, if small contribution to the migration experiments carried out during the year in the North Sea by the various countries under the scheme of international investigations, and has in this respect, we understand, been not unwelcome. It has its own importance, moreover, in that it deals entirely with the fishes of the in-shore waters. We arranged with Mr. Garstang, who is in charge of the investigations relating to the southern part of the North Sea, to exchange the results with regard to the fishes we have labelled, and we have thus a much better chance of learning if any of our specimens migrate from the district. An instance of this (No. 804) will be seen in the accompanying table. We have to thank Mr. Garstang also for the labels we used in the early part of the season.

MIGRATIONS OF PLAICE (1903).

Number.	Date.	Size.	Weight.	Where Liberated.	Where Captured.	Date.	Size.	Incr
		in.					in.	
804	June 26	$10\frac{3}{4} \times 5\frac{3}{4}$	8 oz.	Goswick Bay	St. Andrew's Bay	Nov. 5	11·3	$\frac{1}{2}$-in 132
913	July 23	$7\frac{5}{8} \times 4\frac{1}{2}$	3 ,,	Blyth Bay	Seaton North Point	Aug. 6	...	.
929	,,	8 $\times 4\frac{1}{2}$	3 ,,	,,	Between Hartley and Seaton Sluice	,, 20	...	.
932	,,	$7\frac{7}{8} \times 4\frac{3}{4}$	3 ,,	,,	Seaton Sluice	Lst. week of Aug.	...	.
939	,,	$9\frac{1}{4} \times 5\frac{1}{2}$	$4\frac{1}{2}$,,	,,	Blyth Bay	Aug. 21	...	..
205	Sept. 9	$8\frac{1}{2} \times 5\frac{1}{8}$	...	Druridge Bay	Druridge Bay off Creswell in 2 fths	Oct. 23	$8\frac{3}{4} \times 5\frac{1}{2}$	$\frac{1}{4}$-in 44 d
279	,,	10 $\times 5\frac{3}{4}$	...	,,	Druridge Bay	,, 1	...	..

The table shows that seven of the marked plaice have been accounted for, and that with one exception they remained on practically the same ground as that on which they were liberated. Three of the four which were liberated at Blyth Bay and recaptured had moved a slight distance to the south, and the same may be said of the Creswell specimen. But the one which was recaptured at St. Andrews is very interesting, in that it had travelled across the mouth of the Forth from Goswick Bay, a distance in a straight line of 42 miles.

It would not be right to draw any inference from this solitary example, and we are the more unwilling to do it in this case for the fish was captured in Skate Roads, and liberated at Goswick Bay. But we may be excused for saying that it is certainly remarkable that in the case of both the experiments on migration we have conducted during the year, we have had to record a movement to the north. It would indeed be important if such investigations were to show that in our region there was a general migration in this direction to compensate so to speak in some degree at least for the southward movement of the ova and fry.

It is worthy of note, moreover, that although we sometimes caught again on the same day at the same place a few of the plaice we had just liberated, we did not catch any of the marked fishes when the same station was subsequently visited.

CONFERENCES WITH FISHERMEN.

No arrangements were made this year for the holding of formal conferences, but opportunities presented themselves for interviewing the fishermen at Berwick, Holy Island, Sea Houses, Beadnell and Craster. At Berwick, a table was presented by Mr. Buglass detailing for eight months of the year the catches of cod and haddock at Berwick and Spital, and it is interesting when compared with the similar tables published in former years.

	Cod.		Haddock.	
	Cwts.	Value.	Cwts.	Value.
January	1,252	£857	189	£202
February... ...	665	546	107	119
March	392	278	118	141
April	153	87	96	116
May	229	166	198	138
June	248	129	110	151
July	70	34	41	32
August	59	35	47	43
Total ...	3,068	£2,132	906	£942

It is clear from such a comparison that cod fishing was not so successful this year, but at the same time the figures are far above those of 1901. The haddock fishing was better this year, but compared with the immediately preceding years, the record interferes but little with the steady decrease which has characterised this branch of the industry. The crab fishing in the northern district shows this year a decrease compared with last year, but that year was an especially successful one. At Craster we were informed that crabs started casting this season fully three weeks earlier than usual. The lobster fishing has all over the district been very successful this season. The herring fishing has only been very moderate, and compared with the record season of last year would be called by the men poor. The weather, however, often prevented the boats from going to sea.

The fishermen find it a matter of great difficulty to get bait. Some of them have managed to get a supply from Blyth. Budle Bay has evidently been given up by those who tried to work it as a mussel farm, but it appears from some enquiries which have been addressed to us that the local fishermen are in the mind to see what they could do in this way for themselves. It is a project which it is to be hoped the proprietor will encourage for if the fishermen join hands in a matter which so closely affects them as this, and work the beds with a view to their development, we feel sure

that it will be the fault of the place and not of the men if the farm prove unsuccessful. There are some disabilities about Budle Bay to which we have already in a previous report drawn attention. But it appears to us that if the place be modified on the lines we have recommended to one correspondent that these would be considerably reduced.

We have already made an experiment to find out how far the Coquet was suitable for mussel culture, but unfortunately, after the experiment was finished, it seemed to be nobody's business to undertake the work on commercial lines. The Blyth is well known to the fishermen as a river which may be reckoned upon for a supply of mussel bait, but the quantity is limited and soon exhausted. This river and the Tweed may be made to be valuable if limited sources of bait, but only if some trouble be taken to improve them. Other places on the coast are worth enquiring about as well, notably Fenham Flats.

The Committee have been and are considering the best means of controlling and regulating the mussel fisheries in the district with a view to providing a regular supply, but they have no power to undertake the industrial work, and it is therefore to be hoped that the fishermen or others interested will take the initiative.

The proposed combined effort on the part of the fishermen reminds us of a suggestion we have made before, viz., that in their ordinary business as fishermen some degree of co-operation is desirable, if they are to successfully cope with the modern condition of the industry. It is quite plain that the present method so generally adopted of every fisherman being his own merchant is a very wasteful one, and we feel that so long as the method continues, so long will the men be exposed to the losses entailed in sending small parcels by rail, and in marketing such in distant markets. If the word "co-operation" be objected to, let us say "company"; and if we may again put into words what we are thinking of, it is that in a given fishing community, the men or such number of them as are willing should agree to market their catches together. One of their number would be elected to transact the business, to receive the moneys earned, and to pay the bills. Each crew would receive from their clerk a receipt for their catches in every case, and the settling could be done at stated intervals at a meeting of all the members when each would receive his share according to his catches. In view of such an arrangement there does not appear to be any risk of sacrificing individual effort.

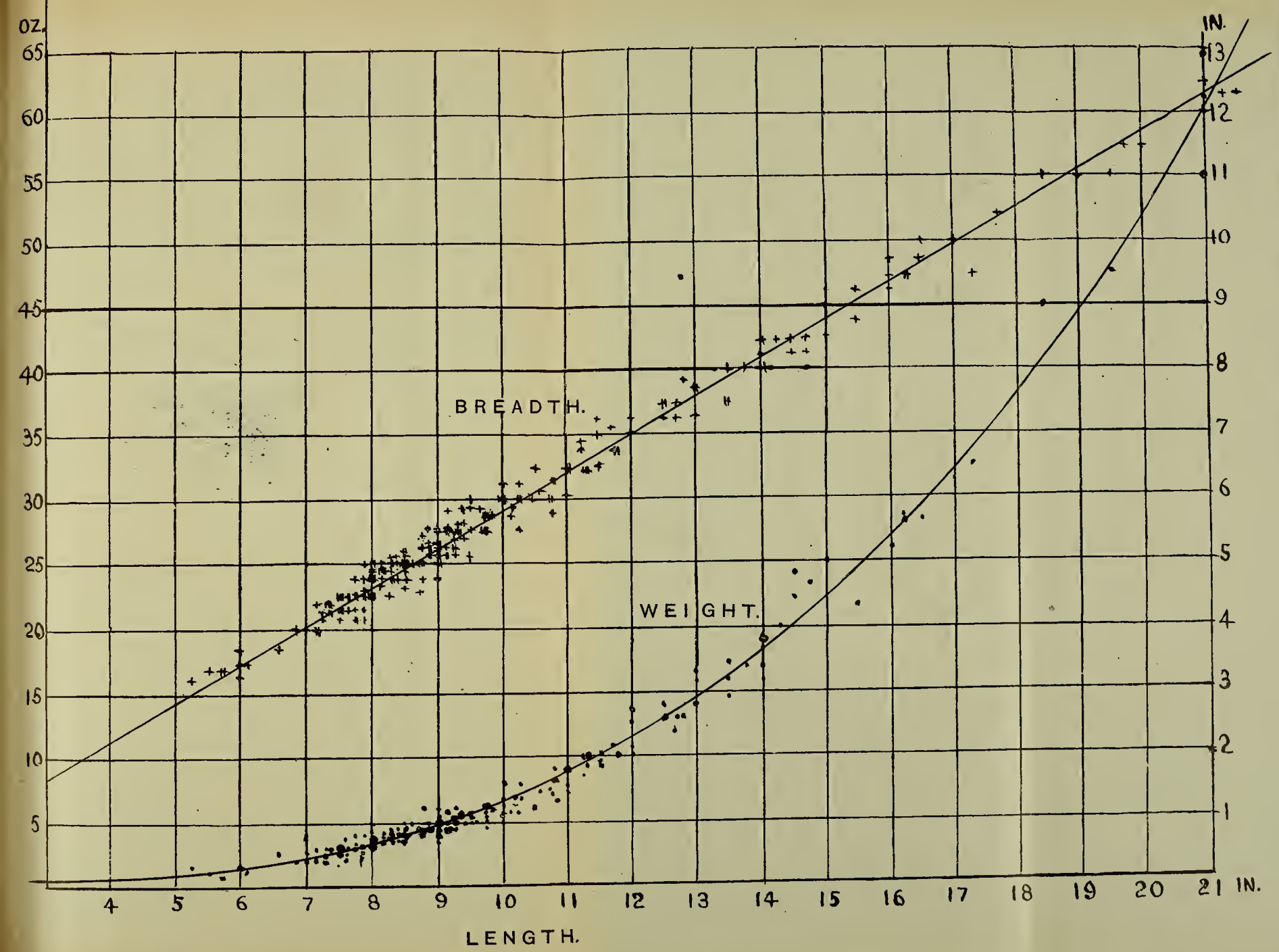
A CONTRIBUTION TO OUR KNOWLEDGE OF THE GROWTH OF THE PLAICE.

By ALEXANDER MEEK, M.Sc.

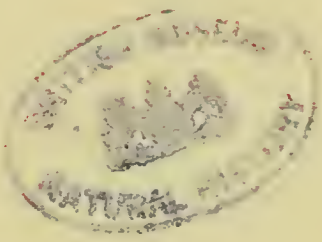
The chart which accompanies this note has been formed by utilising the large number of careful measurements and weights of this species made this year in connection with the migration experiment, together with the similar determinations made for a number of years at the trawling excursions, and one or two obtained at North Shields. It is meant to indicate the relationship between the two ordinary measurements and the weight.

Each of the squares represents one inch of measurement, and it will be seen that when the breadth has been expressed with relation to the length, as in this case by the series of small crosses, the average result is a straight line, sloping at about 30° with the horizontal. The natural tangent of this angle is 0·58, and this number may therefore be taken to express the average relation of the breadth to the length in the case at all events of the plaice of the North East Coast.

As will be apparent by the numbers at the left hand side of the chart, the attempt has been made at the same time to express the weight in ounces in relation to the length, and the numbers in this case form the series of small dots, together forming the average curve shown. I am obliged to my colleague Mr. H. R. Cullen, M.A., for an analysis of this curve of weight. In the first place it is clear from the line representing the breadth that that measurement is practically constant with relation to the length, and it may be presumed that the thickness is equally constant. As a matter of fact the analysis bears this out. On plotting the logarithms of the weight and length, they are found to lie on a straight line of slope 3 to 1; the curve is therefore of the form $w = k \times l^3$; or the weight is proportional to the cube of the length. This is the relationship for bodies of similar shape,


OZ.
65
60
55
50
45
40
35
30
25
20
15
10
5
IN.
13
12
11
10
9
8
7
6
5
4
3
2
1
BREADTH.
WEIGHT.
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21 IN.
LENGTH.

PLAICE.



and the fact that the curve follows this law shows that specimens of different lengths are almost precisely similar in form. The constant for three different points on the curve was determined, giving the figures ·0065, ·0067 and ·0068. Taking ·0067, the weight will be found in ounces, if the cube of the length in inches be multiplied by that number.

It is known that the relationship between the breadth and the length is not that stated for the first few weeks of the fish's life that is to say during the period of transformation, but this period is so short compared with the period of growth that it does not prevent the line of breadth and the curve of weight converging to an origin in 0.

The present most unsatisfactory condition of our knowledge of the growth of this species, makes it impossible for me at present to state definitely the relation of time to the facts expressed in the chart.

ON THE STRUCTURAL CHANGES ACCOMPANYING THE ECDYSIS OF THE CRAB *CANCER PAGURUS.*

By E. P. WITTEN, B.Sc.

(From the Royal College of Physicians' Laboratory, Edinburgh).

The following paper embodies the results of my observations on the histological structures in the soft and the hard crab. Since the preliminary paper of a year ago, I have pursued the subject at the Marine Laboratory, Cullercoats, and continued it at the Laboratory of the Royal College of Physicians, Edinburgh, and for the facilities afforded me at both places, I now beg to tender my sincere thanks.

The macroscopic changes which occur at the period of ecdysis are well known, and it will be useful to briefly recall some of the facts so far as they relate to the problems considered in the present investigation. In the first place there is the phenomenon of sudden expansion so strikingly impressed on seeing the soft crab emerge from the shell and settle down beside it having increased say about one-fourth of its original size. To explain the phenomenon is certainly difficult. The simplest explanation is to assume as is usually done that the tissues have been growing over the whole period since the last ecdysis. This, however, does not appear to be the case. Microscopic examination does not favour this view, nor does an experiment which Mr. Meek has several times made. He carefully stripped off the hard shell from shore crabs about to cast, in most cases very completely, and succeeded in keeping them alive for several hours afterwards. The crabs remained, however, of precisely the original size. This experiment points to the conclusion that the expansion is not due to a gradually increasing pressure from the growth of the tissues, but rather to a sudden

pressure produced more than probably during the process. And if this be ultimately proved to be the case, it is safe to say that the pressure is produced by the ingestion of water and its absorption probably through the digestive gland.

The blood plasma undergoes an enormous increase in volume during ecdysis, and the condition is maintained in a gradually diminishing degree until the completion of the process of calcification. It is for this reason that the name "watery crab" has been applied to the "caster." I have obtained as much as 250 c.c. of blood from a large soft crab. The increase I have presumed to be due to the ingestion and assimilation of sea water as stated above. With the increase in the volume there is associated an increase in the number of blood cells. Cuénot[1] has pointed out that these arise from the lymphatic gland which is situated about the ophthalmic artery, and on the roof of the stomach; and during the period of hardening, the cells of this gland are undergoing active proliferation. On the subsidence of the blood plasma to the degree demanded by the new stage in growth how far these cells persist is yet uncertain, for the relation between the condition of the crab and the number of blood corpuscles is not known.

The excess of blood plasma is more than enough to occupy the increased volume of the blood sinuses, and it may therefore be presumed that it gives the internal pressure necessary for the process of casting, and the gain in size, and also that it furnishes the turgidity connected with the subsequent proliferation and growth of the organs and tissues. This internal pressure was observed by Réaumur,[2] but received a different explanation. He found that the new shell was hard to the touch, and assumed that the condition was due to the muscles being in a state of cramp.

Immediately after casting, the soft shell or cuticle consists only of the outer two layers, but the third or calcified layer begins to be laid down at once. This layer in the exposed region is by far the greatest in thickness, and as Mr. Meek has shown it takes months for the completion of the process, in the adult condition. The thin fourth layer is deposited after the completion of the third.

The attachment of the shell to the underlying tissues is extremely feeble except at the parts where muscles originate or are inserted. In these regions the epithelial cells are very prominent,

1.—Cuénot: Etudes physiologiques sur les Crustacés Décapodes. Archives de Biologie T. xiii., 1895.

2.—Réaumur: Observations sur la mue des Ecrevisses, etc., Mem. de l'Acad. des Sciences, 1718.

Fig. 1.—Hard shell.

Fig. 2.—Epithelium, showing modified cells for attachment of muscle.

Fig. 3.—Seta.

Fig. 4.—Cuticle stripped off shell, showing simple prolongations.

Fig. 5.—*A.* Epithelium in hard condition.

B. General epithelium in soft condition.

C. Epithelium in soft condition, giving muscular attachment.

D. Epithelium underlying gastric mill in soft condition.

Fig. 6.—Formation of tendon.

Fig. 7.—*A.* Appearance of voluntary muscle fibres in soft condition.

B. More highly magnified.

Fig. 8.—Unaffected involuntary fibrillae in muscular tissue of soft condition, showing similarity to fibrillae in hard condition.

Fig. 9.—Small portion of lymphatic gland, soft condition.

Fig. 1.

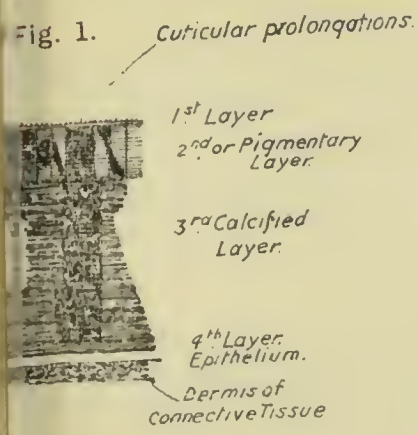


Fig. 2.

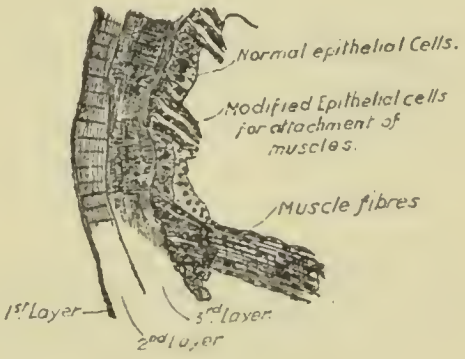


Fig. 3.

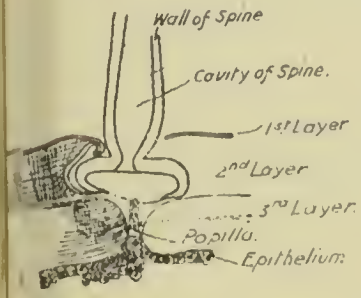


Fig. 4.

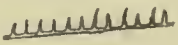


Fig. 5.

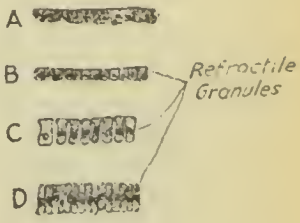


Fig. 6.

Fig 7.

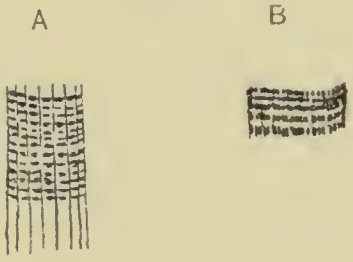
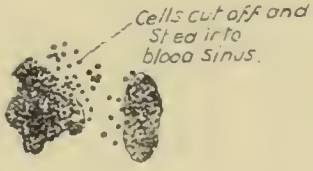


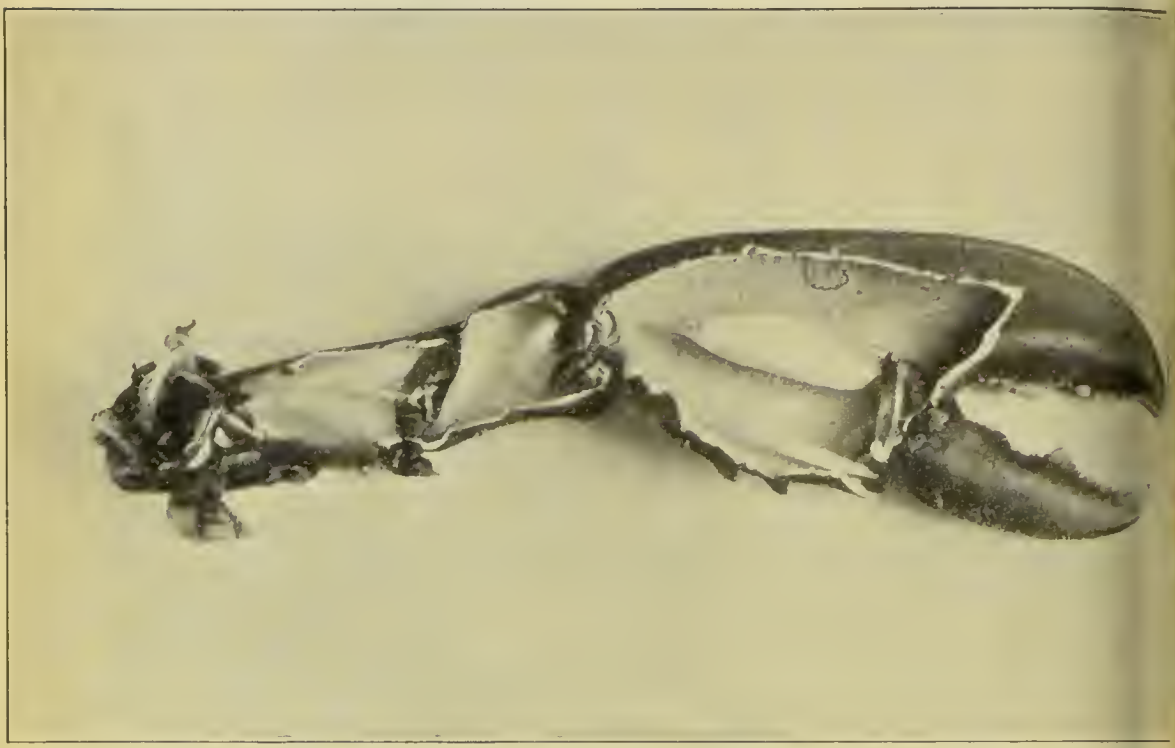
Fig. 8.

Fig. 9.



produced internally for the attachment of the muscle fibres, and are, moreover, firmly welded to the shell.

The tendons and other internal prolongations of the cuticle arises from pocket-like invaginations of the epithelium, and are shed with the rest of the cuticle. It would thus appear that the new tendon cannot arise until the old one is shed, and this may account for the paralysed condition of the limbs for a while after casting.



The exuviated cuticle of the chela of a lobster, showing the large adductor and abduc "tendons" of the dactylopodite, and the smaller "tendons" of the other segments

The setae which are to be seen on the surface of the new shell immediately after sloughing deserve a word. In each case a papilla is to be seen, formed of epithelium, projecting more or less into the cavity at the base of the seta. Each seta consists of a hollow spine with or without barbs at the distal extremity. At the base it expands and occupies a wide space in the pigmentary layer of the cuticle. The spine and the lining of the cavity in the pigmentary layer are produced from the outer layer. As the third layer is produced the papilla projecting into the seta forms a tube which on completion of the shell preserves the communication between the interior of the spine and the epithelium. Simple cuticular prolongations also occur, and it is to be presumed with Vitzou[3] that they have a definite relation with the underlying epithelium.

3.—Vitzou: Recherches sur la structure et la formation des téguments chez les Crustacés Décapodes. Arch. de Zool. Expér. et Général. 1882.

The tissues undergoing most change are the epithelium and the blood. The epithelial cells are almost invariably enlarged, most markedly in the sub-skeletal regions. In the hard condition these cells are small, not well defined, and graduate into the connective tissue cells. But at the period of ecdysis they are much enlarged, arranged in a regular layer, and are in a state of considerable metabolic activity.[4] The periphery of the cell in each case is very distinct, except externally where the secretion is taking place.

The epithelial cells of the digestive and excretory organs are similarly enlarged, so much as to appreciably diminish the lumen of the tubules. The only assignable cause for this distention in the latter case, at all events, is that the cells are preparing to proliferate.

The extraordinary vitality displayed by the epithelium at this period is sustained partly through the agency of the subjacent connective tissue cells. The latter are utilised as transformers, and for the purpose of storing reserve material mainly in the form of glycogen. That variety of the connective tissues which forms a parenchymatous envelope for the intestine carries out the same function, and the other general connective tissues in a lesser degree.

The muscular tissue is at first perplexing on account of the fact that certain muscular fibres show marked change while others again are in a normal condition. On discrimination it appears that all voluntary muscles are affected, whereas some of the involuntary ones are not changed. The large fibres of the muscles of the limbs lose their pronounced margins, and have the appearanceof a somewhat homogeneous mass with very dull and ill-defined striations. The septal zones are not so clear, though the latter is possibly an optical effect due to the former. It is known that myosin which is soluble in salt solution constitutes the main part of the interseptal zone. On treating muscle with salt solution, the interseptal zone becomes transparent and loses its polarising property, owing to the solution of the myosin. This is apparently what takes place in the natural course of events in the case of the voluntary muscles of the crab at the period of ecdysis. Enclosed in their thin investments of endomysium, they are freely bathed in the blood. The salt in solution in the blood appears therefore to act upon the fibres dissolving the myosin, probably producing myosinogen, which is held in solution. The effect is as noted above, the loss of the interseptal pigment, and an accompanying fluidity of the fibres. This is what I consider enables the muscles of the limbs to

4.—According to Vitzou.

be drawn through the small apertures at the base, though the process is probably assisted by the presence of decalcified patches of the cuticle in these regions. After the blood returns to its normal state the myosin will again be laid down. The only change worth mentioning in connection with the involuntary fibres is that an excess of nuclei points to cell division.

In the nervous tissue little change has been noted.

The tubules of the digestive glands in the hard condition present a fairly spacious lumen, and the epithelial cells are constantly throwing off fragments containing secretory and excretory material. In the soft condition the cells are vacuolated, some containing fat, and the tubules are filled with numerous cells which appear to have arisen from the epithelial layer, and which take on the function of reserve cells.

The condition of the reproductive organs has not received further attention. Suffice it to remark that they are immature in both sexes in the soft condition. The testes show germ cells in their lobules, but no sign of spermatogenesis. In the female the ovisacs are not developed from the germ cells. But development in each case, that is after maturity has been reached, of the several elements from the primary germ cells begins soon after ecdysis.

The main points brought out in the above observations are the facts that ecdysis is a period of new birth to the tissues, that so far as the somatic tissues are concerned there succeeds on the renewal of the shell a period of rapid growth which gradually ceases with the calcification of the shell, and that it is probable therefore that the active cause of the ecdysis is not that the growth of the tissues has brought about a state of physiological embarrassment which the casting of the shell would remove, but that the cause is the introduction of a large quantity of sea water which going to increase the volume of the blood, gives the requisite internal pressure for carrying out the process. What, however, is the impulse which prepares the way for the change is at present not at all clear.

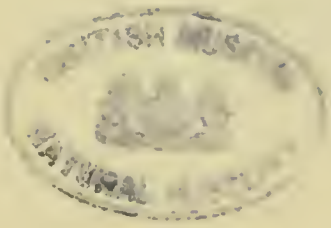


FIG. 1.

Old shell of *Mya truncata* containing patch of eggs of a species of Goby (natural size).

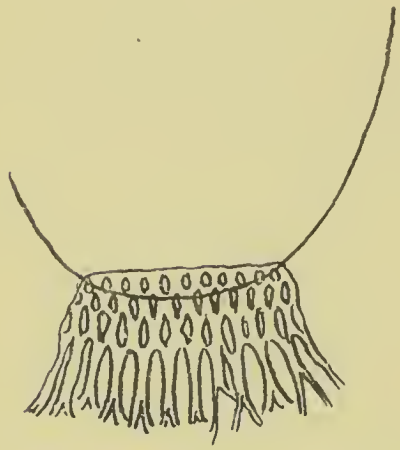


FIG. 3.

Lower end of egg, showing proximal reticulation of threads of attachment (magnified).

FIG. 2.

One of the eggs, with embr (magnified).

ON THE EGG OF A SPECIES OF GOBY.

By A. MEEK, M.Sc.

We are yet almost completely ignorant as to the species of Goby which occur on the North East coast of England, and it is therefore not at all surprising that a patch of eggs belonging to a species of which we have no local record, should be discovered. But the egg to which I now beg to draw attention is important in that it cannot be satisfactorily identified with that of any of the known species.

The patch of eggs of which we give a figure, was found in an old shell of *Mya truncata* brought up in the dredge, on July 25th, 1902, in 25 fathoms, 4 miles east of St. Mary's Island. This was at the annual dredging trip of the Northumberland Coast Club.

A drawing of one of the ova was made by Mr. W. H. Young, F.Z.S., and has been copied to form Figure 2 of the accompanying plate. The others agree closely with that figured, and as will be seen, they are elongated and fusiform in shape. Near the upper end the thin capsule expands slightly before narrowing to form the rounded apex. Below, the narrowing is very slow until near the lower end which is also rounded where the threads of attachment originate. These latter serve to fasten the ova to the shell and to each other. They are reticulate only next the egg in each case.

The egg is about 4 times as long as broad. It measured in the fresh condition 2·077 mm. long and 0·486 mm. broad; in the preserved condition the ova were found to vary between 1·8 and 2·0 mm, long, and the breadth was 0·5 mm. The length of the embryo in the case of the one figured was 1·666 mm. The yoke was yellow in colour with numerous oil globules. Black pigment was scantily present around the yolk sac and on the body.

I sent a drawing of the egg and a short description to Mr. E. W. L. Holt, who, with Mr. Byrne, has recently published an excellent paper on the Gobies of Ireland, and he replied that the egg was new to him, but suggested that it may be found to belong to *Gobius friesii*.

ADDITIONS TO THE LIST OF THE MARINE MOLLUSCA OF NORTHUMBERLAND.

By MARIE V. LEBOUR.

NUDIBRANCHIATA.

Limapontia nigra, Johnston.

Very abundant in rock pools near high water mark on Confervæ, Cullercoats, July, 1903.

Goniodoris nodosa (Montagu).

Two specimens under stones near low water mark, Cullercoats, October, 1902.

Doris bilamellata, L.

Several specimens on rocks near low water mark, Cullercoats.

PECTINIBRANCHIATA.

Trochus helicinus, Fabricius.

Very abundant under stones near low water mark, Cullercoats.

PIT FISH.

A STRANGE HABITAT FOR *GAMMARUS DUEBENI.*

By A. MEEK, M.Sc.

In the report of last year, I mentioned that *Gammarus duebeni* had been sent to me from the Mill Pit at Blyth. This year I put myself to some trouble to find out how the creature had got into such a peculiar situation, and the results of my enquiries I now wish to briefly describe.

Gammarus duebeni is an amphipod crustacean which occurs in brackish water near the mouths of rivers, and also in some places high up on the rocks at the sea-side. The genus furnishes two very common shore species, and one of these, *Gammarus marinus*, may be found with young specimens of the shore or dog crab some distance up our rivers. But these give place a little higher up to *Gammarus duebeni* or its near ally, *Gammarus campylops*, in situations where the pretty and interesting *Neomysis vulgaris* is also to be procured.

I have to thank my friend Mr. W. E. Forster, for drawing my attention to the new and remarkable if accidental habitat of *Gammarus duebeni*, a habitat nevertheless to which the creature has successfully become adapted, every phase of its life-history being passed in it. Mr. Forster informed me that the men who worked in the Mill Pit had mentioned to him that "pit fish" lived in the water in the pit, and when specimens were sent to me, I found them to be the crustacean named. They agree in every morphological detail with the *Gammarus duebeni* found in the usual positions, but they are quite colourless. That is to say, the colour, instead of being as it usually is, a uniform brownish-green with three red spots definitely placed on the side of the body, is a dull transparent white with no red spots. The normal colour is, however, gradually regained when the Gammarus is removed from the pit, the time required for the process depending upon the degree of exposure to the light. For example, a number of specimens were procured on July 8th, and three were placed in a glass vessel opposite a window. In about a fortnight, on the 21st, one was found to have become slightly yellow in colour. It was not until the 26th, however, that a faint lemon yellow tinge was seen on the remaining two. On July 30th, two (males) were found to have become light brown in colour, and the three red spots were now to be seen also. The latter however, were light red to begin with, but in a short time gained in intensity with the general colour of the body. The three subsequently became like

those obtained in the ordinary situations, but it is worthy of note that when they cast their cuticles for the first time after their removal from the pit, the shed cuticle was of the original pigmentless character, while the second exuviation gave a cuticle in each case of a yellow brown colour.

A much larger number of specimens obtained on July 28th, were placed in an earthenware trough, in a position well shaded from the light. A casual inspection from time to time to time showed that they were practically unchanged in colour, and on December 1st, a more careful examination revealed that they were still very lightly tinged with colour, and that the red spots were also quite faint. One however, was found to be almost black, and the red marks were correspondingly strongly prominent.

The eyes on the other hand appeared to be unchanged, though they had a whitish look in the water. The attempt was made to see if the gammarids would take notice of a small object brought near to them, and the result certainly pointed to a partial loss of function. At all events the object was not observed apparently, but when it was brought close to the antennule, the Gammarus suddenly jumped and seized it.

As with other gammarids, the young were observed to take shelter under the appendages of the female.

I had the opportunity, again thanks to Mr. Forster, of visiting the gammarids in their home in the pit, and I was then told that they were first observed about nine years ago, and at that time in the landward workings. They are now found however, in the "second drift," which is a part of the workings under the sea—to be particular, just about under the rocks called the "Sow and Pigs." Here the pit is about 400 feet below low water level. I was told also that the "pit fish" were literally swarming some 4 or 5 years ago, at a time when the drainage water was dammed back to provide a supply for the stable. Now they are not so common, for a special supply of water is led into the pit from the surface, and the gammarids are compelled to live in a small runner from 9 to 16 inches wide, and rarely of a greater depth than 1 inch. In places a depth of about 3 or 4 inches occurs, but a heavy deposit of mud tends to make the depth very small as stated, and in some parts it dimishes, in fact, to $\frac{1}{4}$ of an inch. In this water, which is constantly but slowly running and which I found to be brackish, and to have a temperature of 59° F., an hour after its removal from the pit, the gammarids live and reproduce. A careful examination of the water was made with a view

to discovering other forms of life, but without result. The decaying props, with fungus, an occasional diet of a cannabalistic nature, and such other animals as may be introduced and die in the pit, and perhaps, especially insects and rodents, are what suggest themselves as their food,

I set out, however, with the intention of showing how the crustacean had got into the pit. A resident of Blyth, familar with the changes which that town has undergone during the last generation, would doubtless have been able to have solved the problem with greater ease had he known also something of the habits of *Gammarus duebeni*. I spent some time to begin with examining the river Blyth, from above the harbour to Bebside, and I was surprised and disappointed not to find this species in the situations which appeared to be quite favourable, and I was only successful in obtaining one specimen of *Gammarus campylops*. When I had got thus far, I only learned by accident that the Mill Pit was sunk on the edge of an extensive slake and that the slake had been filled in, and the place now occupied by houses and streets. That such a slake would have been an ideal habitat for *Gammarus duebeni* goes without saying. Some enquiries yielded the further information that the slake communicated with the river at the place now occupied by the lower dry docks, and that on being reclaimed a drain was made which ran through the place occupied by the slake and opened where the latter joined the Blyth; and that moreover it received two ditches, one of which runs past the pit where it also joins the other.

I was able to pay the pit a visit once more on September 11th, and I then found in the ditch first mentioned above, *Gammarus duebeni* along with the 3-spined stickleback. There is no doubt therefore that both these forms have been carried into the pit at times when floods have occurred, that the sticklebacks have died, but the gammarids were able to accomodate themselves to the new habitat, and survived, and this meant accustoming themselves to absence of light and to a practically new and more than probably scanty food.

The pit was flooded three years ago, and a previous flood occured as far back as 1887, i.e., sixteen years since, when the pit in fact was not quite completed. It is more than likely therefore, that the *Gammarus duebeni* was introduced in 1887, and received an accession in 1899.

For the information which led to the solution of the interesting problem, I have to thank Ald. Dent, Mr. Albert Ward, and Mr. Saunders.

OUR LOCAL MARINE ALGAE.

By W. H. YOUNG, F.Z.S., F.R.H.S.

Seaweeds are amongst those kinds of vegetation which are mostly looked upon with some contempt as being of little direct use or interest. They are, however, of considerable scientific interest in many ways; and as they afford a home and a source of food to a great many small marine animals, which in their turn form the principal food of the larger crustacea and fishes, they have an importance of their own, differing only in degree from that of the animal life of the ocean.

It is possible to divide the marine algae of our coast into three main divisions according to their colour, and these divisions also roughly correspond to their distribution in depth of water. The Chlorophyceæ, or green weeds, are mainly found near high water mark, and being exposed to strong light, their green colouring matter serves the same purpose as the chlorophyll of land plants, and is identical with it. The Phæophyceæ, or olive brown weeds, occur not only between tide marks but beyond, in the form of the brown tangles (laminaria), &c., and constitute by far the greatest proportion in number of the weeds, though not in species. They are easily proved to be really plants possessing chlorophyll by treatment with fresh water, which dissolves out their brown pigment (phycophœine), leaving the green visible. The Rhodophyceæ, or red weeds, are found generally shaded from the light by the overhanging masses of brown weed, in the narrow clefts of the rocks, and at the greatest depths. It has been proved that their red colour (phycoerythrine) is in most cases only a mask for the essential green; although the precise influence which this red colour exerts on the blue and green rays of light—the only ones which filter through to such depths—is one of the many interesting scientific problems still awaiting complete solution.

It is probable that on our coast seaweeds rarely occur beyond 15 to 20 fathoms, since no specimens of living weed from any such depths have been brought under my notice during the past year.

It is many years since Professor G. S. Brady, F.R.S., published his detailed list of the Marine Algæ of Northumberland and Durham, and with the exception of a general catalogue of the algæ of Great Britain, issued by Messrs. Batters and Holmes in 1892, in which the east coast of England is included, no special attention has been

given to our local examples. This preliminary attempt to verify the list so far as the immediate neighbourhood of the Marine Laboratory, Cullercoats, is concerned, may therefore be of interest.

During the past summer, fifteen species of Phæophyceæ have been frequently gathered, including *Alaria esculenta*, still used as an edible in some parts of Ireland and Scotland; and the bladderwracks and tangles which deaden the force of the surf beating on the rocks, and shelter the great majority of the smaller animals; five species of Chlorophyceæ, including those called "laver" or "sloke," and used in some parts of the country as food; and the common sea-grass, *Enteromorpha intestinalis* and *E. compressa*, which attach themselves to any object, moving or stationary, and produce such large quantities of oxygen as to swell out the tissues into a buoyant bladder; and twenty-five species of Rhodophyceæ. Amongst the latter are the most beautiful in point of structure, and also some which are of use as food, *e.g.*, "dulse," *Dilsea* (Iridœa) *edulis*, and "carrageen," *Chondrus crispus*.

The list includes probably less than half of those possible to be found, as very few rare ones are given. Systematic dredging just below low-tide mark, would no doubt considerably increase the list of smaller and rarer specimens. For those mentioned I am indebted to Mr. John Taylor, of the Marine Laboratory.

It has already been stated that the masses of weed afford food and shelter to vast numbers of small animals, which in their turn form the sustenance of the larger ones. This applies also to a class of plants not specifically mentioned in this account, which form enormous floating masses of microscopic vegetation, such as the Diatomaceæ and the Peridineæ, the latter causing the surface phosphorescence so often seen. These are consumed as food by pelagic animals, and form, as Mr. George Murray says, "the basis of the pyramid of which man is the apex." In some parts of Scotland and Ireland kelp produced from Laminaria and Fucus has been a staple article of commercial value for the production of iodine, but local enquiries have not brought to light any instance of its use for this purpose on the north-east coast. It has been, and is still used, however, as manure, and in one of the pamphlets recently issued by the Board of of Agriculture and Fisheries, reference is made to its effect on wireworm. As an edible, dulse is known to have been collected here in quantities up to within ten years since. After being dried in the sun it was sent to market in different parts of England.

PHAEOPHYCEÆ (Olive Brown Seaweeds).

Halidrys siliquosa Lyngb, (Podded sea-oak).—Common in all pools between tide-marks.

Fucus vesiculosus, L. (Bladder wrack).—Very common on rocks and stones between tide-marks.

Fucus ceranoides, L. (Horn wrack).—Smuggler's Cave, Cullercoats, and other places.

Fucus serratus, L. (Serrated wrack).—Very common in Cullercoats bay, less so to the north of it.

Fucus nodosus, L. (Knobbed wrack).—Very common on rocks near low water, usually more or less covered by Polysiphonia fastigiata.

Himanthalia lorea (L.) Lyngb (Sea thong).—Common at low water mark: not yet brought to me from the Durham coast.

Desmarestia viridis, Lamour.—Not common.

Alaria esculenta (L.), Grev (Badderlocks).—Fairly common near low water.

Laminaria digitata (L.), Lamour (Tangle).—Very common in deep water and variable in appearance: the largest of our native seaweeds.

Laminaria saccharina (L.), Lamour (Sugary tangle).—Common between tide-marks.

Chordaria flagelliformis, Agardh.—Fairly common.

Elachista fucicola, Fries.—Very common on Fucus vesiculosus, less frequently on F. serratus.

Cladostephus verticillatus, Agardh.—Not very common in pools between tide-marks.

Ectocarpus tomentosus, Lyngb.—On stems of larger weeds: not very common.

Ectocarpus littoralis, J. Ag.—Very common on rocks and on other weeds.

CHLOROPHYCEÆ (Green Seaweeds).

Cladophora rupestris, Kütz.—Common on rocks near low water.

Cladophora laetevirens, Kütz.—Common in pools between tide-marks.

Enteromorpha intestinalis (L.), Link.—Very common above half tide-mark: often swollen by gas, hence its name.

Enteromorpha compressa (L.), Grev (Sea grass).—Very common on rocks, shells, wood, &c., near high tide-mark.

Ulva latissima, Kütz (Sea lettuce or laver).—Very common between tide-marks.

RHODOPHYCEÆ (Red Seaweeds).

Porphyra laciniata, Agardh (sloke, laver).—Abundant at all levels: very variable in form.

Chondrus crispus, Lyngb (Carrageen, Irish moss).—Abundant and variable in colour at different levels.

Gigartina mamillosa, J. Ag.—Common on rocks near low water.

Rhodymenia palmata (L.), Grev (Dulse).—Very common on rocks and on stems of laminaria, &c.

Chylocladia articulata, Grev.—Common on rocks.

Chylocladia clavellosa, Grev.—On washed up stems.

Plocamium coccineum, Lyngb. (Braided Hair).—Very common on other algæ and on rocks.

Nitophyllum laceratum, Grev.—Not common.

Delesseria sanguinea Lamour.—Common below low tide-mark.

Delesseria alata, Lamour.—Principally on other algæ.

Rhodomela subfusca, Agardh.—Common, but variable in appearance.

Odonthalia dentata, Lyngb.—Somewhat rare, a peculiarly northern species. No specimens brought this summer from Durham coast, although it is found in Cullercoats bay.

Polysiphonia urceolata, Grev.—Not uncommon between tide-marks.

Polysiphonia fastigiata, Grev.—Very common on stems of Fucus nodosus.

Griffithsia setacea, Agardh.—Occasionally washed up.

Callithamnion arbuscula, Lyngb.—Not uncommon on rocks and shells.

Ptilota plumosa (L.), Agardh.—Common on laminarian stems.

Ptilota elegans, Kütz.—On rocks, but not on laminaria.

Ceramium rubrum, Agardh.—Very common at all levels and variable.

Ceramium acanthonotum, Carm.—Not uncommon at low water.

Dumontia filiformis, Grev.—Between tide-marks.

Iridea edulis Bory, (Dulse).—In the deeper water and washed up: not often in pools between tide-marks.

Polyides rotundus, Grev.—Rock pools.

Corallina officinalis, L.—Very common at all levels.

Melobesia polymorpha, Lamour.—Common on rocks, &c., between tide-marks.

ICHTHYOLOGICAL NOTES.

By ALEXANDER MEEK, M.Sc.

The following notes are taken to a large extent from a paper contributed to the Transactions of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne.—New Series, Vol. I., Part 1.

Red Mullet. *Mullus barbatus*, Linn.

The red mullet is landed not infrequently at North Shields by trawlers from the local fishing grounds. The specimen in the Laboratory collections was captured on 10th March, 1903, seven miles off Blyth.

Black Sea Bream. *Cantharus lineatus*, Fleming.

Mr. Holmes, fish merchant, Berwick, informed me that he had a specimen which was caught a few years ago inside the piers at Berwick.

Sapphirine Gurnard. *Trigla hirundo*, Linn.

A small number were captured at Blyth and Cambois Bays in 1902, and one in 1903, which from its size appeared to represent a year's growth in advance of those of the previous year. The species is also occasionally captured by trawlers in the deep water off the coast.

Sharp-tailed Lumpenus. *Lumpenus lampetriformis*, Walb.

One specimen of this interesting northern fish was captured living by the Laboratory fisherman, Mr. John Taylor, at Cullercoats, at extreme low water mark, on 12th February, 1903. As this is the first time it has been definitely recorded for England, the following particulars are given. The length is 10·4-in., the head 1-in., the vent $3\frac{1}{4}$-in. from the anterior end. The colour when fresh was light green, with patches of darker green, the dorsal fin white with two or three black spots on the rays, which together formed oblique bands sloping from above, downwards, and backwards; the caudal fin also with black spots. The body compressed and band-shaped, the height being not quite $\frac{1}{2}$-in. The fin formula is: D. 72 spines, A. 1 spine and 48 rays, C. 12 rays, P. 14, V. 1 spine and 3 long rays.

It was first recorded for Britain by Dr. Day, in 1885, from a specimen got by Professor McIntosh, 15 miles off St. Abb's Head, in 40 fathoms, and since then it has been obtained in the Firth of Forth during the trawling experiments of the Scottish Fishery Board; in the Firth of Clyde (Günther, and also T. Scott and A. Brown); and in the Moray Firth by G. Sim, Aberdeen. Holt obtained a specimen from 240 miles E. ½-N. of the Spurn Light-vessel in 1892, and stated that "Dr. Günther informs me that he has seen a specimen said to have been taken on the coast of Norfolk."

Five-bearded Rockling. *Motella mustella*, Linn.

Common in the rock-pools at Cullercoats and generally on the coast.

Four-bearded Rockling. *Motella cimbria*, Linn.

Common in about 30 fathoms.

Witch. *Pleuronectes cynoglossus*, Linn.

Common in deep water, and landed regularly at North Shields from the nearer fishing grounds.

Thickback. *Solea variegata*, Donov.

I recorded the capture of an example of this species in my report for 1897, and I have since had my determination confirmed by Cunningham. The specimen was captured 45 miles N.E. of the Tyne. It is very rare in the North Sea, and this is the only record I know of for the east coast of England.

Megrim. *Lepidorhombus megastoma*, Donov.

Rare on the east coast of England.

Shad. *Clupea alosa*, Linn.

Captured in trawl, in trout, and in herring nets occasionally. A specimen from Mr. Douglas, Beadnell.

Sun-fish. *Orthagoriscus mola*, Linn.

A small specimen was captured by Mr. Crisp, St. Mary's Island, in his salmon nets in July, 1903, and he kindly presented it to me. It had the following measurements:—Length, 20-in.; height in front of median fins, 13¼-in.; and from tip of dorsal to tip of anal fin, 30-in.

Tope. *Galeus vulgaris*, Flem.

Sometimes caught by trawlers on the near fishing grounds.

Shagreen Skate. *Raia fullonica*, Linn.

Fairly common.

Homelyn. *Raia maculata*, Montagu.

Rare.

Cuckoo Ray. *Raia circularis*, Couch.

Rare. Our specimen was caught ten miles off the Coquet on 6th October, 1903.

Thornback. *Raia clavata*, Linn.

Common. This is the species we capture at our trawling experiments.

Starry Ray. *Raia radiata*, Donov.

Very common. Called at Shields "Jenny Hanover."

Sting Ray. *Trygon pastinaca*, Linn.

A specimen from six miles off Cresswell, December, 1897, and another handed in at the Laboratory, 1901.

I beg to take this opportunity of stating that I have to thank Mr. Harry Taylor, the Committee's Fishery Officer for the southern part of the district, for many of the specimens mentioned in the above notes, notably for the Four-bearded Rockling now recorded for the first time for the district.

NOTE ON THE BELUGA CAUGHT AT THE MOUTH OF THE TYNE.

By ALEXANDER MEEK, M.Sc., F.Z.S.

Reprinted from the Transactions of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne.—
New Series, Vol. 1., Part 1.

The capture of a White Whale or Beluga, *Delphinapterus leucas*, Pall., in our district is an event of some importance, seeing that the species has not hitherto been recorded south of the Forth. The Forth specimen was obtained in 1815, but further north in Scotland and on the west coast the Beluga has been stranded or captured pretty frequently. The local specimen was captured at the South Shields sands on the morning of June 10th, 1903, in the nets of the salmon fishermen. The whale was observed by the fishermen after he had approached close to the shore, and they at once made the attempt to surround him with their nets. Three nets were brought into use, and he was ultimately entangled in one of them. Two ropes were fastened to his tail, but he was able to tow the two boats some four miles to sea before he was exhausted. The carcase was landed at the Fish Quay, North Shields, and sold to Messrs. Relph and Hall. It is gratifying to be able to say that these gentlemen, with a public spirited generosity which happily is not rare on Tyneside, have presented the skeleton to the Hancock Museum.

The thanks of the Society are due also to Mr. W. H. Young, F.Z.S., who, recognising the importance of the capture, put himself to a great deal of trouble to obtain the photograph which is here reproduced*, and to Mr. Robinson by whom the photograph was taken.

Mr. E. P. Witten, B.Sc., obtained the following measurements:— Length, 14 feet 2 inches; girth, 7 feet 8 inches; the gape measured 12 inches; and the eye, which had a longitudinal diameter of 1 inch, was placed about 4 inches behind the angle of the mouth.

* I have to thank the Council of the Nat. Hist. Soc. for the use of the block.

My absence from home at the time prevented my seeing the specimen until the second morning after its capture, and by that time the skin had been removed and the dissection completed. I was able, however, to confirm the determination which had been made by my co-workers at the Cullercoats Laboratory that it was a full-grown male example, and to make arrangements for the conveyance of the skeleton to the Museum. It was then possible to see that there were eight teeth in each jaw, or thirty-two altogether.

The fishermen at different parts of the north-east coast have reported that another White Whale was seen on several occasions during the summer.

Photograph of Beluga caught at the Mouth of the Tyne, June 10th, 1903.
Length of one foot is given by the piece of white paper held up behind the animal.